The 2010–2011 Integrated Rainfall Variability Impacts, Needs Assessment and Drought Risk Management Strategy

Department of Disaster Management
Office of the Prime Minister

September 2012

UGANDA

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With financial and technical support of GFDRR/World Bank

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Foreword

Uganda has for many years experienced droughts and food shortages resulting from rainfall deficits and variability. With the increased manifestation of negative effects related to climate change and global warming, this challenge is becoming greater. And with increased public awareness about disasters and disaster risks, communities are ceasing to portray droughts as mere acts of nature and are therefore eager to contribute to sustainable solutions.

Like many other disaster risks in Uganda, there are several factors influencing the risk of droughts including; human and social vulnerability coupled with overall capacity to predict, respond to or reduce disaster impact. Environmental degradation, lack of adequate investments in agricultural production, underdeveloped irrigation systems, lack of mechanization, limited use of fertilizers, poverty and low levels of disaster preparedness at community level are some of the other contributing factors increasing the drought risk.

Research plus accurate and consistent information flow is crucial if Uganda is to develop any sustainable approaches to drought risk reduction. This report therefore is a positive step towards this direction. The assessment of socio-economic effects and impact of the 2010 – 2011 rainfall deficits is the first of its kind which sought to establish whether Uganda, like other countries in the Greater Horn of Africa, suffered a drought in 2010/ 2011. In the same effort, the assessment established the losses and damage caused by the rainfall deficits of the same period and presents in detail recovery and reconstruction needs and possible disaster risk reduction and management measures for mitigating future disasters including drought.

In order to build a basis for comparison and to determine macro-economic impacts, baseline information was collected from several sectors including agriculture, livestock, energy, agro-processing, trade, statistics, food relief / aid, water, education and health among others. This baseline information was compared with data and information collected from the field and used to estimate the damages and losses.

This report therefore provides both qualitative and quantitative evidence of the impact of the recent rainfall deficits on the different sectors and overall impact on GDP. The 2010/11 rainfall deficit caused an estimated loss and damage value of 2.8 trillion (US$ 1.2 billion), which is an equivalent of 7.5% of Uganda's GDP in 2010. This therefore calls for systematic approaches to mitigate disaster effects in order to safeguard the socio-economic gains and development prospective. Examples of such strategies have been highlighted in chapters IV &V of this report.

It is my hope that all sectors of Government, Non –Government, Development Partners, Private Sector and general public will pique interest in the findings and recommendations of this report and together will support implementation of critical activities. I also believe this report will inspire further similar assessments for other common hazards / disasters and practical action at all levels (especially the community level) and raise awareness on drought risk.

Pius Bigirimana
Permanent Secretary
Office of the Prime Minister

Acknowledgments

This report is the product of a team effort, and we would like to take this opportunity to thank everyone for their dedication and immense contributions to the process, starting from the development of the concept to the start of the assessment—including the data collection and analysis—to the report writing.

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This report greatly benefited from the strategic and technical guidance of Mr. Pius Bigirimana, Permanent Secretary in the Office of the Prime Minister, and Mr. Keith Muhakanizi, Deputy Permanent Secretary/Secretary to the Treasury in the Ministry of Finance, Planning and Economic Development.

The report was prepared by a team from the World Bank led by Suleiman Namara and Mary Bitekerezo and comprised of Asmita Tiwari, Carl Christian Dingel, Sajid Anwar, Mohinder Mudahar, Mr. Prashant, Obert Pimhidzai, Isaac Mutenyo, Harriet Nattabi, Willy R. Kagarura, and Minna Hahn Tong. The team is greatly indebted to Roberto Jovel, the author of the DaLA Assessment Methodology, who trained the data collection team, provided technical guidance on data collection, analyzed the data, and participated in the report writing. The team also included Barbara Nalugo for support in processing the consultants and field visit logistics, Gladys Alupo and Rose Mary Mugasha for the formatting of this report, and Marc C. Neilson, who helped in finalizing the report.

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Acronyms and Abbreviations

ABEK	Alternative Basic Education for Karamoja
CBDRM	Community-based disaster risk management
CDD	Community-driven development
CFW	Cash for work
CMDRR	Community Managed Disaster Risk Reduction
Cumecs	Cubic meters per second
DaLA	Damage, Loss, and Needs Assessment
DCM	Drought Cycle Management
DDMC	District Disaster Management Committees
DRARAP	Disaster Assessment and Resilience Action Plan
DRM	Disaster risk management
DRR	Disaster risk reduction
DSIP	Development Strategy and Investment Plan
DWRM	Directorate of Water Resource Management
ECLAC	United Nations Economic Commission for Latin America and the Caribbean
EU	European Union
FAO	Food and Agriculture Organization
FFW	Food for work
GDP	Gross Domestic Product
GoU	Government of Uganda
HDI	Human Development Index
IDA	International Development Association
MDPRR	Department for Disaster Preparedness, Relief and Refugees
MW	Megawatts
MWE	Ministry of Water and Environment
NECOC	National Emergency Coordination and Operations Centre
NDP	National Development Plan
NGO	Non-governmental organizations
NWSC	National Water and Sewerage Corporation
OPM	Office of the Prime Minister
SFP	School feeding program
SLM	Sustainable Land Management
SLWM	Sustainable Land and Water Management
UBOS	Uganda Bureau of Statistics
UCDA	Uganda Coffee Development Authority
UETCL	Uganda Electricity Transmission Company Limited
UGX	Uganda Shillings
UN	United Nations
UNDP	United Nations Development Programme
US$	United States Dollars
UTA	Uganda Tea Authority
WB	World Bank
WfAP	Water for Agriculture Production
WFP	World Food Programme

Executive Summary

In early July, the Office of the Prime Minister, through its Permanent Secretary, sent an official request to the World Bank-Global Facility for Disaster Reduction and Recovery (GFDRR) for assistance to conduct an integrated drought impact and needs assessment with a view of developing a longer term program for capacity building on disaster preparedness and management. The Government of Uganda wanted to conduct a full-fledged, integrated analysis that could provide the building blocks for a medium to long term drought prevention, management and resilience building strategy. The analysis would also benefit its climate change adaptation and disaster risk reduction and management program. Finally, the analysis would focus on other possible shocks that affect agriculture, livestock production, livelihoods, basic services, energy and other sectors. Using the Damage, Loss and Needs Assessment (DaLA) Methodology, the following assessment addresses these challenges and concludes with a drought risk management strategy.

Although Uganda has not been as seriously affected by the current drought when compared to nearby countries in the Greater Horn of Africa (Djibouti, Ethiopia, Somalia), the recent rainfall deficit situation has had significant negative impacts on the country's economy and food security. These deficits have had major implications for Uganda's agricultural and energy sectors. The rainfall variability conditions have led to food shortages, food price increases, and energy deficits.

Key Findings

Rainfall deficits experienced in certain areas of Uganda in 2010 and 2011 affected the country in meteorological, agricultural, hydrological and socioeconomic terms. Regardless of the fact that the Government did not declare a state of emergency, the rainfall deficits appear to have been anomalous in those areas of the country for which data is available. As discussed in the following sections, these rainfall deficits have clearly had negative impacts on various sectors of the economy and society. However, it is recognized that rainfall deficits did not cover the entire country evenly and that their intensity varied across locations.

Damages and Losses

The value of damage and losses caused by rainfall deficit conditions in Uganda in 2010 and 2011 is estimated at 2.8 trillion Shillings or US$ 1.2 billion. This amount is equivalent to 7.5 percent of the country's gross domestic product (GDP) in 2010. Three types of effects were identified: (i) damage in the form of death of livestock, (ii) losses in the production of goods and services, and (iii) higher costs of production of goods and services. As shown in Table 1, most of the total effects represent production losses and higher costs, rather than the value of destroyed physical assets.

Table 1: Summary of damage and losses caused by the 2010-2011 rainfall deficit

Sector	Sub-sector	Damage and losses, billion Shillings			
		Damage	Production losses	Higher production costs	Total
Agriculture		**106.2**	**1,969.6**	**85.4**	**2,161.2**
	Food crops		911.8		911.8
	Livestock	106.2	934.9	85.4	1,126.5
	Cash crops		123.0		123.0
Agro Industry			**278.0**		**278.0**
Commerce			**39.2**	**130.7**	**169.9**
Electricity				**106.3**	**106.3**
Water			**0.6**	**1.3**	**1.9**
Health				**14.9**	**14.9**
Education				**48.6**	**48.6**
Food Aid				**16.9**	**16.9**
TOTAL (billion Shs.)		**106.2**	**2,287.3**	**404.1**	**2,797.6**
TOTAL (US$ million)		**44.6**	**1,129.5**	**169.6**	**1,174.1**

Source: Estimations by Assessment Team.

Damage and losses from the 2010-2011 rainfall deficits were heavily concentrated in the productive sectors, particularly crop and livestock. In terms of individual sectors and sub-sectors of economic activity, most affected were livestock (1.1 trillion Shillings, or 40.3 percent of the total) and the production of food and cash crops (1.0 trillion Shillings in damage and losses, or 37.0 percent of the total). The next highest losses were experienced in agro-industry (278.0 billion Shillings, or 9.9 percent of the total), commerce sales (169.9 billion Shillings, or 6.9 percent of the total), and electricity production (106.3 billion Shillings, or 3.8 percent). In contrast, the combined costs of water and sanitation, health care provision and nutrition assistance, education, and food assistance for the affected population amounted to only about 2.9 percent of total losses. **98 percent of damage and losses were sustained by private individuals and enterprises compared to only 2 percent for the public sector.**

The losses caused by the rainfall deficits of 2010-2011 also produced impacts at the macroeconomic level. The estimated impact of the rainfall deficits on GDP performance was 3.5 percent of GDP growth for 2010 and 2011. In other words, if the rainfall deficit had not occurred, the Ugandan economy would have grown by a combined 3.5 percent more in those two years. Production losses and higher costs of production for the affected sectors also had a negative impact on Uganda's exports and imports. If the rainfall deficit event had not occurred, it is estimated that Uganda would have experienced a 2.5 percent improvement in its balance of payments in 2010 and a similar positive impact in 2011. Similarly, the current government deficit in 2010 would have been 7.5 percent lower and the expected surplus for 2011 would have been 7.1 percent higher if the rainfall deficit had not occurred. In addition, Uganda faced higher-than-normal prices of basic food products due in large part to the scarcity brought about by domestic food production losses, and inflation in 2011 rose significantly.

Recovery and Reconstruction Needs

Based on the estimated damage and losses from the 2010-2011 rainfall deficits, the recovery and reconstruction needs are estimated at 423.9 billion Shillings or US$ 173.0 million. Table 2 summarizes the

Table 2: Summary of damages, losses, and needs

Sector	Damages and losses			Needs		
	Damages	Losses	Total	Reconstruction	Recovery	Total
Crops		1,034.7	1,034.7		137.2	137.2
Livestock	106.2	1,020.3	1,126.5	123.8	56.8	180.7
Agro Industry		278	278		77.3	77.3
Commerce		169.9	169.9			
Electricity		106.3	106.3			
Water		1.9	1.9		1.1	1.1
Health		14.9	14.9		13.2	13.2
Education		48.6	48.6			
Food Aid		16.9	16.9		14.4	14.4
TOTAL (billion Shs.)	**106.2**	**2,691.4**	**2,797.6**	**123.8**	**300.1**	**423.9**
			US$ Millions			
Crops		434.3	434.3		56.0	56.0
Livestock	44.6	428.2	472.8	50.5	23.2	73.7
Agro Industry	-	116.7	116.7		31.5	31.5
Commerce	-	71.3	71.3			
Electricity	-	44.6	44.6			
Water	-	0.8	0.8		0.5	0.5
Health	-	6.3	6.3		5.4	5.4
Education	-	20.4	20.4			
Food Aid	-	7.1	7.1		5.9	5.9
TOTAL	**44.6**	**1,129.5**	**1,174.1**	**50.5**	**122.5**	**173.0**

estimated damage and losses and the corresponding recovery and reconstruction needs by sector. About one third (32.4 percent) of total recovery and reconstruction needs is for activities related to food and cash crops. Livestock alone accounts for around 42.6 percent of the total needs. The total needs of the agriculture sector therefore comprise 75.0 percent of all recovery and reconstruction needs. This breakdown underscores the overwhelming need to tackle food-related issues, as drought is synonymous with food insecurity in the country.

Building Resilience

Although recovering from the drought will be costly, it is small compared to the costs of not implementing the necessary activities. Uganda will use this opportunity to not only "build back better" but also to implement changes that will help the country be better prepared for future disasters of any type. If adequate measures to reduce risks are not put in place, similar disaster-related impacts are likely to recur. The last major drought in Uganda from 2005 to 2007 is still fresh in people's minds and rainfall deficits leading to drought are expected to be a more frequent phenomenon due to climate change. Since the country has a heavy dependence on agricultural production, a proactive effort is needed to strengthen the backbone of both the economy and livelihoods.

Investing in Disaster Risk Reduction

Given the country's vulnerability to drought, Uganda recognizes the need to strengthen its disaster risk reduction (DRR) and disaster risk management (DRM) efforts. Important measures currently planned

following the assessment include establishing a sound legal and institutional foundation for DRM at the national and local levels; formalization of the DRM structure for Uganda; mainstreaming DRR into governance, planning, and budgeting systems and strengthening the capacity of communities to empower them to act on their own in case of emergencies. A comprehensive disaster risk assessment is also needed to update existing information—especially on drought—and scientific data for predicting and forecasting disasters also needs to be improved to aid in disaster preparedness. DRR/DRM activities aimed at achieving full disaster resilience in the country are estimated at approximately US$ 258 million.

The 2010-2011 rainfall deficit is also viewed as a trigger for addressing important development issues in Uganda. The effects of water deficits in Uganda are related to the country's current state of development and the inherent challenges of limited technology. The disastrous effects of drought are not unexpected for a country that is considered to be well-endowed with water resources but that still heavily relies on rain-fed, subsistence agriculture. Much of the agricultural production technology is traditional, basic and haphazard, with limited irrigation and almost no use of fertilizers. Furthermore, farmers lack relevant skills, capital, adequate planning and access to information on new advances in the management of public affairs.

Uganda will rise to the challenge of implementing advanced recovery and reconstruction programs which will, in return, spur modernization of the affected areas; particularly in the most drought affected areas of the North and Northeast (Karamoja sub-region) as well as the "cattle corridor" districts. Investment in DRR is key step in the country's ongoing modernization and economic development.

Introduction

Water is one of Uganda's most critical and valuable resources and its availability has direct implications on the country's overall development, particularly given the predominance of rain-fed agriculture which is highly susceptible to any variations in rainfall. Water is also crucial to livestock health and therefore for overall food security. Notably, Uganda's food security situation is affected by current rainfall trends as well as its geographical position and regional role as an exporter of food. The country is now overwhelmed by the regional demand for food as it serves the East African Great Lakes region as a major exporter. Water levels are also crucial to Uganda's power supply, as the majority of the country's energy generation comes from hydropower sources.

With recurrent droughts due in part to climate change factors, the country is at risk of severe water crisis. The most recent severe drought in 2006 resulted, among other things, in lower water levels in Lake Victoria, with a consequent reduction in hydroelectric generation and a rationing of power supply. As a result, Uganda experienced significant economic losses lasting more than one year, which contributed to rising food prices in the country. Other localized dry spells occurred in 2008, 2009, 2010, and 2011, particularly in northeastern Uganda and the so-called "cattle corridor"; a large region with extensive pastures for grazing.

Most recently, the country has been affected by insufficient rainfall as part of the current La Niña weather patterns in the Greater Horn of Africa. Although the effects of the drought have not been as severe for Uganda compared to Somalia, Kenya, Djibouti, and Ethiopia, the rainfall deficits have had major implications for Uganda's agricultural and energy sectors. The drought conditions have led to food shortages, food price increases, and energy deficits.

It has become imperative for Uganda and other countries vulnerable to such disasters to determine the economic impacts and long-term prevention needs. This helps determine key areas to be addressed and, more importantly, offer opportunities to reduce economic losses. In the case of Uganda, the magnitude and spatial extent of the 2005-2006 drought were estimated to have caused damages and losses of around 627 billion shillings (US$250.3 million), and the vulnerability of the population is still at higher-than-desirable levels. The macro/sectoral impacts of the past prolonged rainfall deficit periods have also not been estimated. Particularly in light of the current Horn of Africa drought and the experiences of countries being underprepared for such emergencies, it is important for Uganda, like other countries, to analyze the economic impacts and estimate the long-term prevention needs for drought and rainfall deficit situations.

Recognizing the critical importance of such an analysis, the government of Uganda (GoU) requested an assessment of the effects of the recent rainfall season failures on key sectors. In July 2011, the government requested an integrated drought impact and needs assessment to be carried out led by The World Bank. The government-led initiative was supported by experts in the following sectors: agriculture; agro-industry; trade and commerce; energy; drinking water supply, sanitation, and water for production; health; and education. The assessment aimed to determine the impacts that rainfall deficits can have on these sectors, as a basis for long-term drought prevention and management measures and for more extensive and encompassing disaster risk assessment and management options. It should be noted that the work did not attempt to address humanitarian assistance requirements; rather, the assessment was intended to help inform strategies for disaster risk reduction and prevention.

This report presents the results of the impact assessment, including interpretations of the analyzed data and findings as well as key recommendations. The GoU team, with the support of the World Bank, conducted field data collection and analysis. A detailed analysis of damages and losses was also completed which included: (i) trends in rainfall variability since 1960; (ii) effects of water deficits on yields; (iii) whether there has been a drought in Uganda or not; (iv) total value of damage and losses arising from rainfall variability in 2010 and 2011; (v) ownership of damage and losses; (vi) breakdown by type of effects; (vii) time distribution of effects; (viii) impacts on selected sectors, including crop and livestock, food processing, electricity, health and nutrition, water and sanitation, and education; and (ix) impacts on GDP growth, balance of payments, government deficits, prices and inflation and on households and individuals. This report also draws from background notes explaining some of the findings.

The report is structured as follows:

Section I describes the rainfall variability situation in Uganda, including an analysis of whether the 2010-2011 rainfall deficits met the definition of a drought.

Section II summarizes the overall damage and losses caused by the water deficits, including macro-economic impacts.

Section III provides a more in-depth discussion of damage and losses resulting from the water deficits in several key sectors.

Section IV presents the recovery and reconstruction needs.

Section V Understanding the risks through an historic perspective

Section VI presents disaster risk management strategy and the way forward plus conclusion

Rainfall Variability in Uganda

SECTION I

Uganda's geographical location makes it susceptible to recurrent droughts, which usually affect the most vulnerable areas of the country. These vulnerable areas are already grappling with high water stress, rapid population growth, environmental degradation, and low socio-economic growth. Climate change, likely bringing a 1-3 degree rise in temperature and higher precipitation variability[1], may further increase the frequency and intensity of rainfall deficits in the region.

The rainfall deficit and subsequent dry situation has had significant negative impacts on the country's economy and food security. Since 2010, countries in the Greater Horn of Africa region have been facing a very serious drought. The situation has reached famine stage in some areas of Somalia, becoming a humanitarian crisis that is being addressed by the region's governments with the support of the international community. Unlike some of its neighboring countries, Uganda did not declare an emergency, although it has faced difficulties caused by a decline in rainfall and water availability.

This section presents an analysis of the available rainfall data to ascertain the extent of the rainfall deficit in Uganda during 2010-2011. Figure 1 shows a map indicating the location of existing rainfall stations for which data was available for the analysis. The rainfall stations at Gulu and Mbarara (marked red in Figure 1) have reliable and continuous long-term records dating back to at least 1960. Other stations (marked blue) have information covering more limited and recent time periods. Although the geographical coverage of these stations is less than ideal, the information they provide at least enables a look at spatial rainfall trends for the country as a whole. The analysis utilized monthly and annual rainfall data for these stations to describe the meteorological event that affected Uganda in 2010 and 2011.

It should be noted that for future analyses, the very limited number of operating rain-gauging stations in Uganda must be increased to ensure adequate data availability. Although Uganda in the past had over one thousand stations where daily rainfall was measured, at the present time, due to budget and institutional constraints, less than one dozen rain stations are fully operational and produce reliable information.

[1] IPCC 4th Assessment Report, http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html

A. Analysis of rainfall data

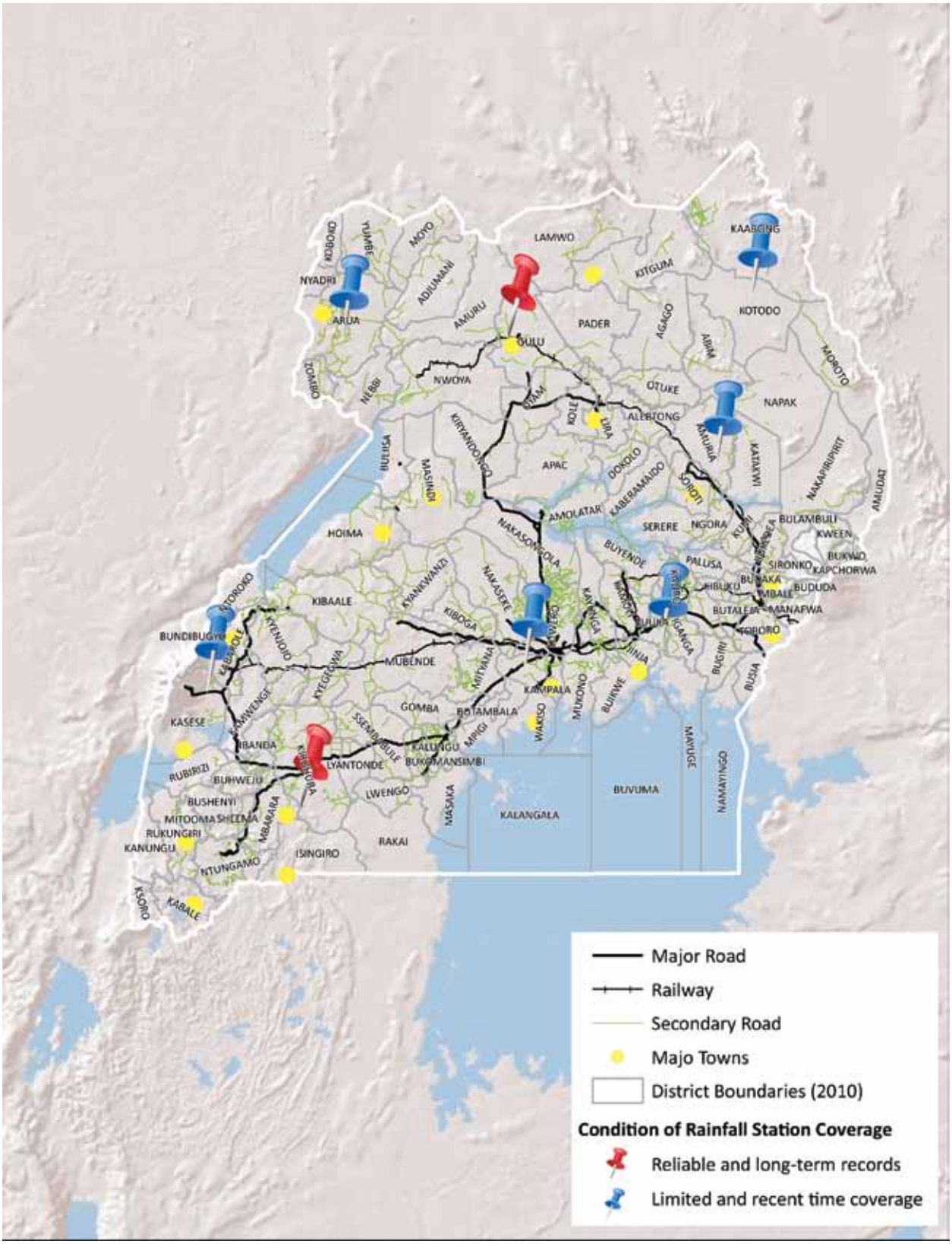
At first glance, analysis of *annual* rainfall records seems to suggest that Uganda did not experience anomalous rainfall rates in 2010. Using the available rainfall records for Gulu and Mbarara, the annual precipitation that occurred at these locations in 2010 was determined. The available information shows that the annual rainfall rates were slightly above the long-term average values, which could be viewed as an indication that Uganda did not experience anomalies in rainfall availability in 2010 as part of the Greater Horn of Africa drought.

While the annual rainfall data do not reveal obvious rainfall anomalies for 2010 and 2011, an analysis of monthly data shows that many months had below-average rainfall. Monthly rainfall data from six stations, which are scattered throughout the country as shown in Figure 1, was used to compare actual monthly rainfall amounts from January 2010 to July 2011 to the long-term average monthly value. The comparisons reveal that during the period studied, there were significantly long periods in which actual monthly rainfall was below the long-term average for each location. In most of the locations, monthly rainfall was below the long-term average around 60 percent of the time over the entire 19-month period (Table 3).

Table 3: Number of months with rainfall was below long-term average (Jan 2010 to July 2011)

Location	Number of months having rainfall below average	Percentage of time below average
Arua	12	63
Gulu	11	57
Jinja	11	57
Kasese	10	52
Mbarara	7	36
Soroti	11	57

Figure 1: Map showing locations of rainfall-measuring stations used for analysis



B. Did Uganda experience a drought?

Although the problems they cause are well-recognized, droughts are difficult to define. There is no single universally accepted definition of a drought because a drought, unlike a flood, is not a distinct event. A drought is often the result of many complex factors such that it often has no well-defined starting or end point. Furthermore, the impacts of a drought vary among different sectors of economic and social activity, making the definition of a drought specific to particular affected groups.

The most commonly used drought definitions are based on meteorological, agricultural, hydrological, and socioeconomic considerations. A *meteorological drought* often refers to a period of lower-than-normal precipitation duration and/or intensity. An *agricultural drought* occurs when there is inadequate soil moisture to meet the needs of a particular crop at any given time. A *hydrological drought* refers to deficiencies in the availability of surface and groundwater supplies. A *socio-economic drought* may occur when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought affects the supply and demand of the production of goods and services.

The frequent rainfall-deficit periods[2] indicate that Uganda did experience a meteorological drought, although with less intensity and geographic coverage compared to other countries in the Greater Horn of Africa. The analysis clearly shows that 2010 and 2011 were anomalous in meteorological terms. As discussed above, a comparison of available monthly rainfall data with long-term monthly averages reveals that rainfall deficits did occur for significantly long periods of time in the areas studied. Charts were developed showing the departure of actual monthly precipitation from the long-term average for each of the stations to determine the time periods in 2010 and 2011 when rainfall deficits/surpluses did occur. Figure 2 shows an example of that comparison.

The analysis also shows that some areas of Uganda experienced an agricultural drought during this period. To determine whether an agricultural drought occurred, crop water requirements in 2010 and 2011 were analyzed using the normal calendar of agricultural activities for the country. Potential evapotranspiration was estimated based on existing air temperature and solar radiation data, using standard procedures. Specific water requirements for the typical crops planted in each region of the country were estimated based on their stage of growth and were linked to the potential evapotranspiration rates estimated previously. Superimposing the estimated crop water demands on the available effective rainfall for the period showed that many seasonal crops and permanent plantations faced water deficits over several months.[3] These water deficits would have caused stress on the plants and resulted in production and productivity declines. As an example, Figure 3 illustrates the case of millet and sugarcane water demand versus availability of effective rainfall in one location of Uganda.

Additional evidence shows that Uganda did face several months in which selected crop water demands were unmet by available rainfall and livestock were affected. The Ministry of Agriculture received reports that many families in different locations faced the failure of family garden plots with different crops due to insufficient water availability. In the livestock subsector, cattle had to travel relatively long distances to find forage and water after their usual sources failed to provide their normal requirements. When going to other feed and water sources, the cattle herds came in contact with animals coming from other areas and contracted disease, and some of them died as an indirect result of the rainfall deficit.

The impacts on other sectors of economic activity indicate that the rainfall deficits in Uganda may also fit the definition of a socio-economic drought. In addition to crop production, other sectors of economic activity were negatively affected by the rainfall deficit. For example, actual rainfall in the Lake Victoria basin

[2] A rainfall deficit occurs whenever actual rainfall is below the long-term average value.

[3] Effective rainfall was assumed as 80 percent of observed monthly rainfall, after deducting runoff and evaporation.

Figure 2: Identification of rainfall deficit periods at Gulu in 2010 and 2011

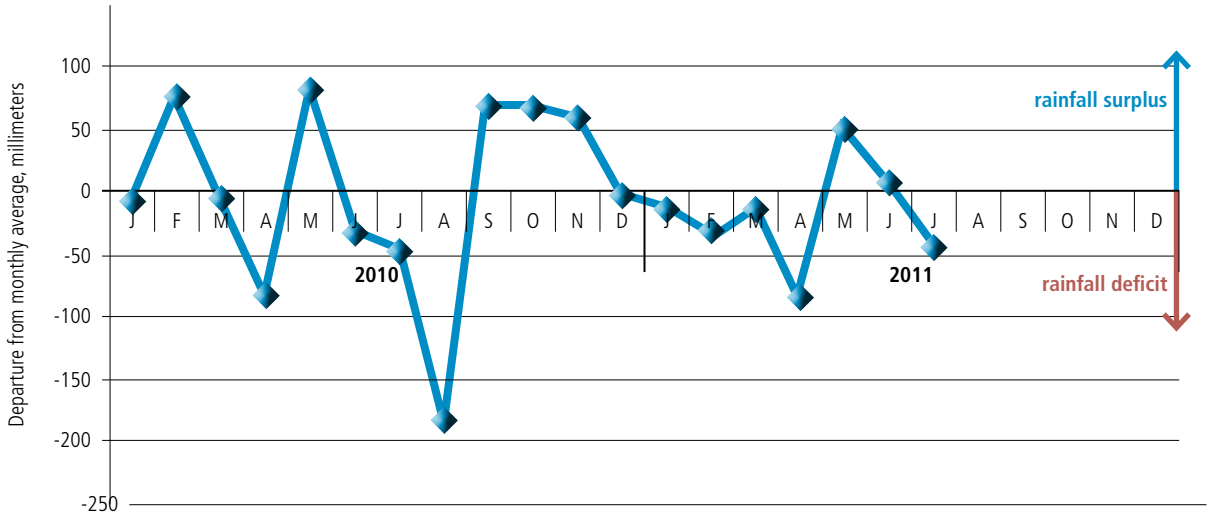
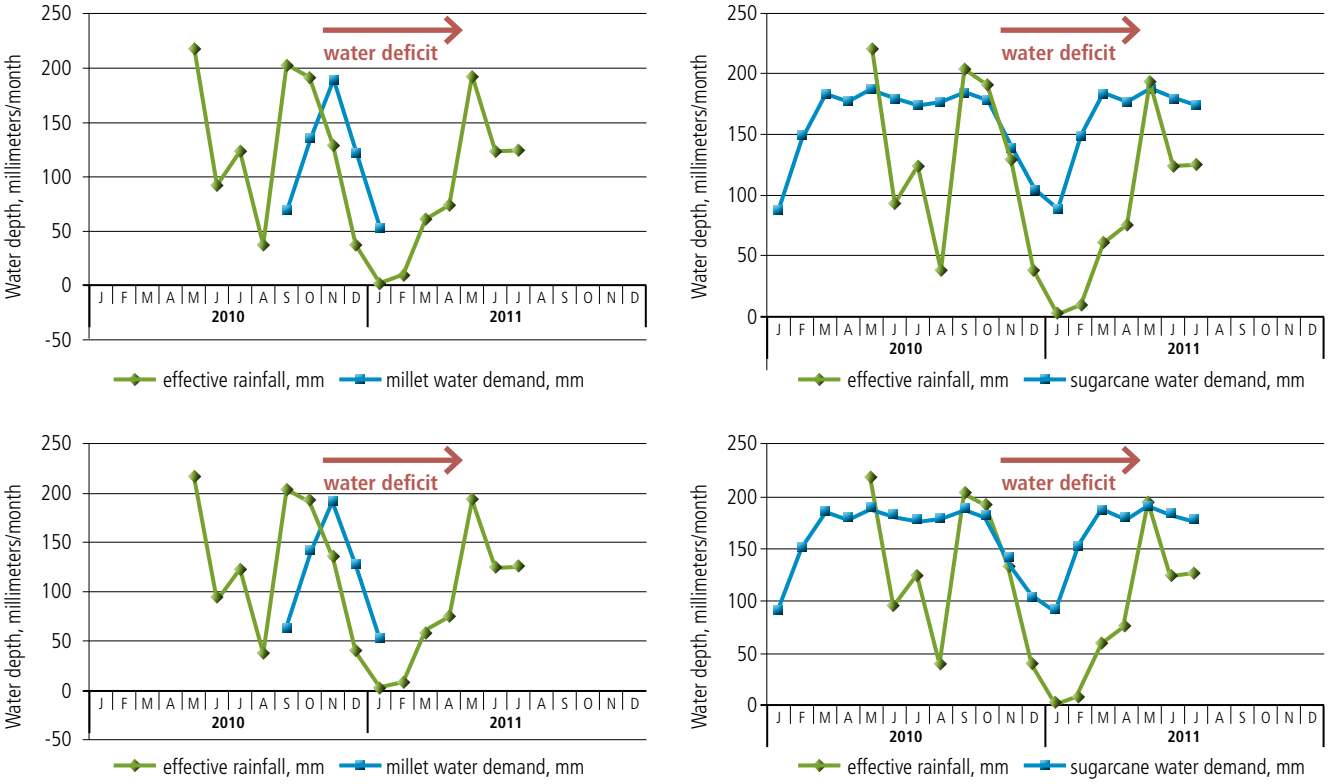


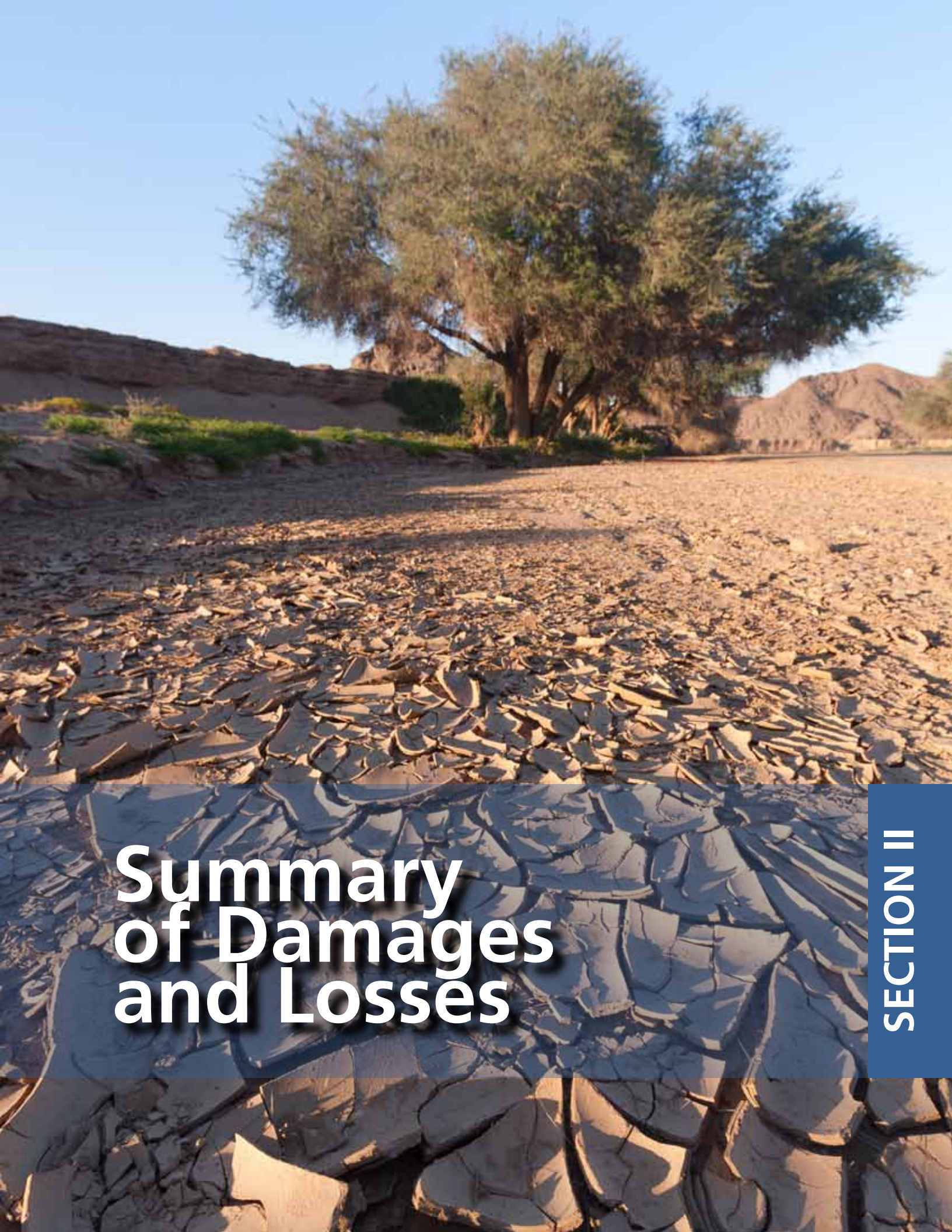
Figure 3: Comparison of selected crop water demands and effective rainfall availability, 2010 - 2011



was insufficient for hydropower generation to meet electricity demand, and larger amounts of electricity had to be generated by thermal power plants that require imported fuel. Load shedding was instituted, causing production losses for industries and trade shops.

C. Conclusion

The analysis suggests that the rainfall deficits experienced in certain areas of Uganda in 2010 and 2011 did constitute a drought in meteorological, agricultural, hydrological, and socioeconomic terms. Although Uganda may not have experienced rainfall deficits as severe as those being experienced by other countries in the Greater Horn of Africa, and regardless of the fact that the government did not declare a state of emergency, the rainfall deficits appear to have been anomalous in those areas of the country for which data is available. As discussed in the following sections, these rainfall deficits have clearly had negative impacts on various sectors of the economy and society. However, it is recognized that rainfall deficits did not cover the entire country evenly and that their intensity varied across locations.



Summary of Damages and Losses

SECTION II

Using the DaLA (Damage, Loss and Needs Assessment)

This assessment used DaLA methodology to estimate the effects of rainfall deficits in 2010 and 2011. The DaLA methodology, which was initially developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in the 1970s, has evolved into a globally recognized tool for quantifying the impacts of major disasters.[4] It enables measurement of the value of effects of any shock to an economy and society, such as the damage or destruction of durable assets and the changes or losses in flows of the economy. It also enables an estimation of the impact of damage and losses on the overall functioning of the economy and on the well-being of individuals or households. It forms the quantitative basis for estimating the financial requirements to reduce disaster risk and increase disaster resiliency.[5]

The assessment estimated damage, losses, and macroeconomic impacts, defined as follows:

Damage refers to the total or partial destruction of physical assets. It occurs during the natural event causing the disaster. Damage is measured in physical units, and its monetary value is expressed in terms of replacement costs.

Losses refer to changes in flows of production of goods and services that arise from the disaster. They occur after the natural event, over a different timeframe. Losses are expressed in current monetary values.

Macroeconomic impacts refer to the impacts of damage and losses on GDP, balance of payments, fiscal position, and prices and inflation.

The assessment process involved numerous steps, beginning with a full training on the application of the DaLA methodology for GoU personnel and international development partners. The trainees then collected baseline information on physical asset availability, the production of goods and services in each sector of economic activity, and the macroeconomic situation. Field visits were undertaken to 12 representative districts in the affected areas to collect data on damage and production losses for all affected sectors. The field visits included discussions with district officers, affected farmers, and other individuals. This data collection provided the quantitative information necessary to estimate the effects of the rainfall deficits, their impact on the country's overall economy, and their impact at the personal/household levels. A similar, less-detailed analysis of the effects of the 2005-2007 drought in Uganda was also conducted.

A. Overview of Damage and Losses

Estimated Value of Damage and Losses

The estimated value of the effects caused by rainfall deficit conditions in Uganda in 2010 and 2011 amounts to 2.8 trillion Shillings (US$ 1.2 billion).[6] This amount is equivalent to 7.5 percent of the country's gross domestic product (GDP) in 2010, which provides a measure of the magnitude or relevance of the rainfall deficits for Uganda's economy.[7] Three types of effects were identified: (i) damage in the form of death of livestock, (ii) losses in the production of goods and services, and (iii) higher costs or prices for goods and services. Table 4 summarizes the damage and losses across various sectors, which will be discussed in greater detail in Section III.

The majority of drought effects are production losses and higher costs, rather than the value of destroyed physical assets. As shown in Table 4 above and Figure 4, production losses in many sectors of economic activity totaled approximately 2.4 trillion Shillings,

[4] For details on the DaLA methodology, see the Handbook for Estimating the Socio-Economic and Environmental Impact of Disasters by ECLAC (2003).

[5] See *Damage, Loss and Needs Assessment Guidance Notes*, Volumes 2 and 3, Global Facility for Disaster Reduction and Recovery (GFDRR), The World Bank, Washington, D.C., 2010.

[6] These official exchange rates, defined by the Ministry of Finance, were used throughout the assessment: 2,323.5 Shillings per U.S. dollar in 2010 and 2,442 Shillings per U.S. dollar in 2011.

[7] This comparison should not be construed as the rate of decline of Uganda's GDP, which will be described later and which would occur in both 2010 and 2011.

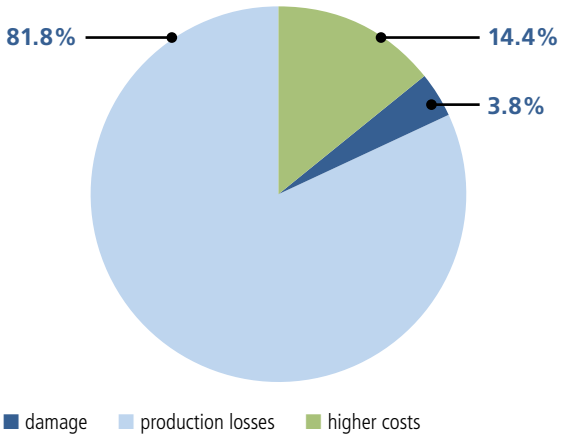
Table 4: Summary of damage and losses caused by the 2010-2011 rainfall deficit

Sector	Damage	Production losses	Higher costs	Total
Crops		1,034.7	–	1,034.7
Livestock	106.2	934.9	85.4	1,126.5
Agro Industry		278	–	278
Commerce		39.2	130.7	169.9
Electricity		–	106.3	106.3
Water		0.6	1.3	1.9
Health			14.9	14.9
Education		–	48.6	48.6
Food Aid		–	16.9	16.9
TOTAL (billion Shs.)	**106.2**	**2,287.3**	**404.1**	**2,797.6**
TOTAL (million US$)	**44.6**	**959.9**	**169.6**	**1,174.1**

Source: Estimations by Assessment Team.

equivalent to 81.8 percent of the total effects. Higher costs of production or sales of goods and services amounted to approximately 387.2 billion Shillings, or 14.4 percent of the total effects. In comparison, damage represented by the value of domestic animals that died as a result of the rainfall deficits amounted to an additional 106.2 billion Shillings, or 3.8 percent of the total effects.

Figure 4: Distribution of damage and losses by type



Source: Estimations by Assessment Team.

Looking by type of ownership, the private sector sustained most of the impact of the rainfall deficits. Damage and losses were heavily concentrated in the private sector, with 98 percent of damage and losses being sustained by private individuals and enterprises compared to only 2 percent for the public sector. The public sector bore the higher costs of providing some services to the population, including health, food and nutrition assistance, drinking water distribution, and higher electricity costs due to thermal power generation.

Damage and losses from the 2010-2011 rainfall deficit appear to be much greater than those from the 2005-2007 drought (the last severe drought), although a full comparison is hindered by data availability. Box 1 summarizes the effects of that drought, which had an estimated value of damage and losses of US$ 380 million, a fraction of what occurred in 2010-2011. The difference in effects between the two events can be explained by several factors. First, Uganda's population has grown, and productive activities now cover a larger area of the country. Second, recent human settlements have been made in more climate-wise vulnerable areas. In addition, it is quite possible that the effects of the 2005-2007 drought may have been underestimated, given the lack of fully detailed information on the event.

Box 1: Effects of the 2005-2007 Drought in Uganda

Quantitative historical information obtained during the assessment of the 2010-2011 rainfall deficit event was used to estimate the effects of the 2005-2007 drought, using the DaLA methodology. The losses in productivity and production of goods and services, as well as the higher costs incurred to ensure their minimum availability for the affected population, were estimated. The resulting macroeconomic impact was also analyzed to provide a sense of the overall magnitude of the disaster caused by the drought.

Sectoral losses

As shown in Table 5, the losses caused by the 2005-2007 drought varied by sector. The most affected individual sectors, in order of decreasing magnitude, were electricity generation (46.7 percent of the total losses), agriculture and livestock (20.2 percent), food processing industry (15.3 percent), and trade (7.1 percent). The water supply, health, and education sectors together sustained 10.7 per cent of total losses.

The total value of losses, duly adjusted for inflation and expressed in 2010 terms, is currently equivalent to 628.0 billion Shillings or US$380 million. The average production loss arising from the drought was 27,500 Shillings per person.

Table 5: Summary of estimated losses caused by the 2005-2007 drought in Uganda

		Losses, million Shillings (Current values)				
Sector	**Subsector**	**2005**	**2006**	**2007**	**2008**	**Total**
Agriculture		60,204.5	56,177.0	9,465.0	344.2	126,190.7
	Food crops	203.2	719.1	677.5		1,599.9
	Cash crops	54,528.2	50,350.9	7,927.0		112,806.1
	Livestock	5,473.1	5,107.0	860.5	344.2	11,784.8
Manufacturing*		27,207.4	41,469.8	29,561.6		98,238.8
Trade		21,071.6	19,661.9	3,312.8		44,046.3
Electricity		57,723.2	99,705.7	75,678.1	58,213.9	291,321.0
Other sectors **		19,944.8	26,041.7	14162.1	7,027.0	67,175.6
Total		**186,151.5**	**243,056.2**	**132,179.5**	**65,585.1**	**626,972.4**

Notes: *refers to processing of sugar, tobacco, tea, Robusta coffee, and grains; **includes water supply and sanitation, education, health, nutrition, and food assistance.

Source: Estimations by Assessment Team.

Agriculture and livestock. The reduced availability of water had a negative impact on crop production and productivity for both food crops and cash crops. It also affected cattle and other domestic animal stocks, resulting in lower availability of meat and milk products which continued into 2008, when animal stocks recovered naturally to pre-drought levels. These production losses affected food availability, resulting in higher market prices of foodstuffs and increased malnutrition rates among the population in the affected areas. Losses in cash crop production caused lower exports of these products and had an adverse impact on the producers' earnings. Agriculture sector production losses were estimated at 126.2 billion Shillings, spread over the four-year period 2005-2008.

Manufacturing. The losses in primary production in the agriculture sector had a subsequent negative **Trade.** Traders had a lower quantity of agriculture and livestock goods to sell due to the losses caused by the drought, and domestic prices of some of the goods rose as a result. However, farmers and cattle growers did not benefit from the higher unit prices because they normally occurred after the crops had been harvested. Urban area consumers faced higher food prices, which reduced their net family earnings. The total volume of sales was lower than in normal years, and corresponding losses in sales totaled 44.0 billion Shillings in the drought period.

Box 1: (continued)

Electricity. When the drought occurred, Uganda had been utilizing more water than had been agreed for electricity generation in the hydropower plants at Lake Victoria. When the rains began to decline, the level at Lake Victoria also fell, and the country was forced to reduce power production and availability. Electricity sales dropped significantly during 2005-2008 while power generation in thermal power plants increased, with correspondingly higher production costs due to the need to use diesel fuel. The consumers, in turn, faced shortages of electricity which resulted in production losses (accounted for under each consumer sector). Losses in the electrical sector were estimated at 291.3 billion Shillings over four years, making it by far the most affected sector of economic activity. In addition to those losses, the increased fuel imports required for operation of the thermal power plants had a negative impact on the balance of payments for Uganda.

Water supply. In urban areas, collective water supply systems faced shortages of water to meet increasing demands by consumers, and correspondingly lower revenues for the services. They also sustained higher costs in the distribution of water. Urban consumers did not receive the full normal water supply and were forced to purchase from alternative sources, thereby increasing their normal cost of living. In rural areas, individual or family wells dried up, and the affected families were forced to spend long hours fetching water from other, far away sources. The increased time in these chores prevented the families from conducting other normal, income-earning activities. In turn, the above-described drought effects caused increased health problems.

Health and nutrition. The health sector was affected by the increased costs of attending to higher morbidity rates of disease—including diarrhea, cholera, and skin disorders—and providing special attention to higher malnutrition rates among the vulnerable population.

Education. Children temporarily stopped attending school when they were required to undertake income-earning work and water-fetching activities for their families. In doing so, they lost access to the food provided to them at school and thus faced education losses as well as increased malnutrition rates.

Macroeconomic impacts

GDP growth. Due to the occurrence of the drought, GDP grew at slower rates than expected during 2005-2008. GDP slowed by a combined 3 percent rate during and after the drought—in other words, if the drought had not occurred, GDP would have grown by a combined 3 percent higher rate than it actually did during 2005-2008.

Balance of payments. As mentioned above, the drought caused a decline in the value of traditional exports of sugar, coffee, tea and tobacco and an increase in imports of fuel for electricity generation, resulting in a worsening of the current account of the balance of payments by a total of US$217.3 million during 2005-2008.

Fiscal sector. Higher and unforeseen government expenditures, in some cases partially financed by external donors, were necessary to provide medical attention in response to drought-induced morbidity rate increases as well as to partially finance higher costs of drinking water provision in some affected areas. As mentioned earlier, lower tax revenues were collected due to the decline in processing and sales of affected commodities. effect on the food processing industry, since lower amounts of raw materials were processed at the mills. The net losses—after discounting the value of the primary products accounted for under the agriculture sector—were estimated at 98.2 billion Shillings for the three-year period 2005-2007. Traditional exports of the main cash crops fell significantly in the same period, with the corresponding negative impact on Uganda's balance of payments. Value-added tax collections declined, as well, affecting the fiscal position of the country.

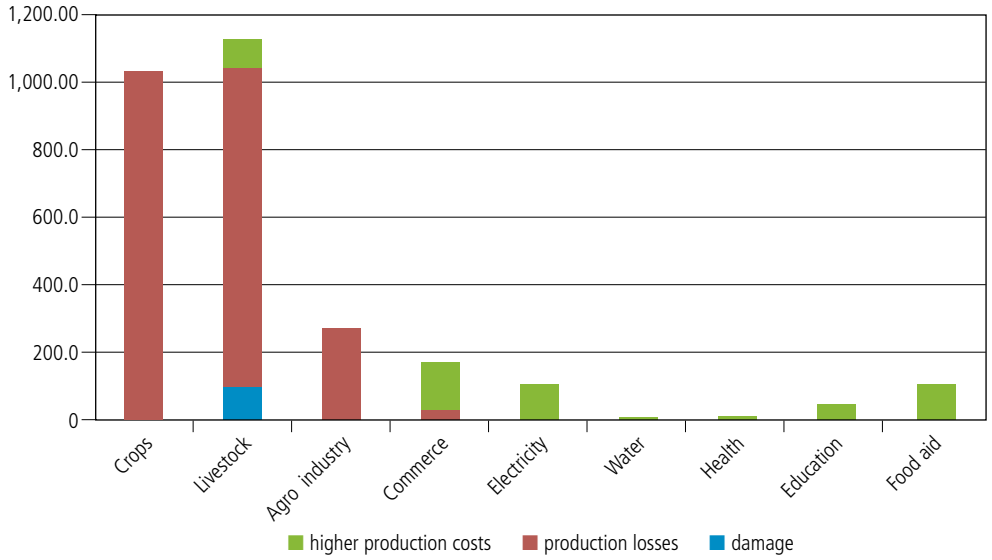
Sectoral Distribution of Damage and Losses

Damage and losses from the 2010-2011 rainfall deficit were heavily concentrated in the productive sectors, namely crop, livestock, industry, and commerce (Figure 5). In terms of individual sectors and sub-sectors of economic activity, most affected were livestock (1.1 trillion Shillings, or 40.3 percent of the total) and the production of food and cash crops (1.0 trillion Shillings in damage and losses, or 37.0 percent of the total). The next highest losses were experienced in agro-industry (278.0 billion Shillings, or 9.9 percent of the total), commerce sales (169.9 billion Shillings, or 6.1 percent of the total), and electricity production (106.3 billion Shillings, or 3.8 percent). In contrast, the combined costs of water and sanitation, health care provision and nutrition assistance, education, and food assistance for the affected population amounted to only about 2.9 percent of total losses.

Time Distribution of Damage and Losses

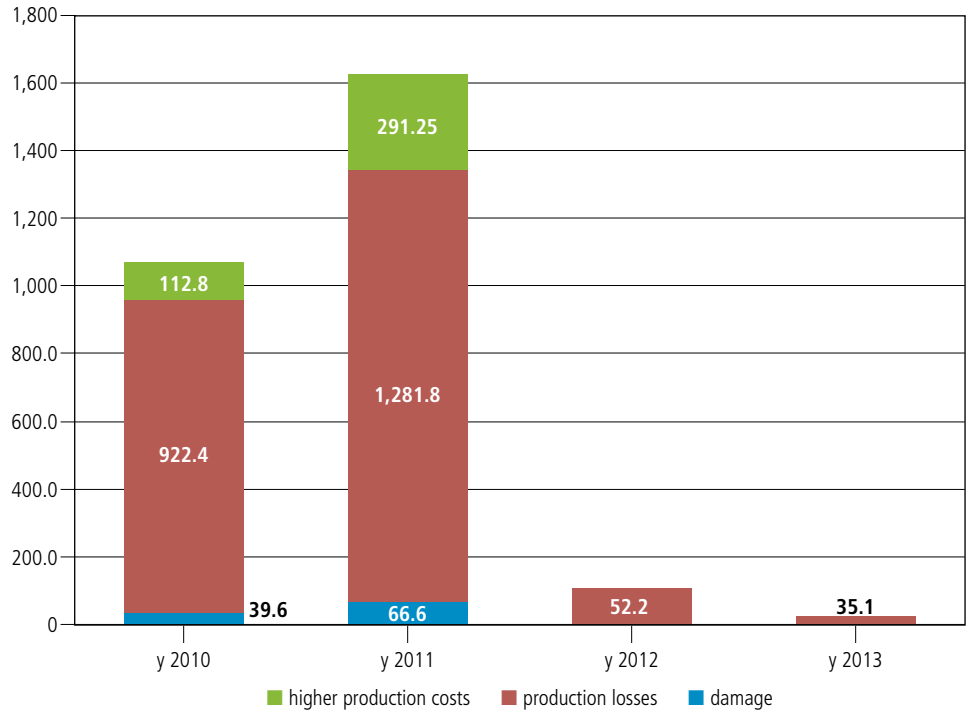
Since the rainfall deficit was a slow-evolving event, the damage and losses were spread over time. The damage and losses started in early 2010 and lasted at least until September 2011, when the rains began to normalize. However, some of the losses—such as those in the production of meat and milk—are expected to continue and stop only in 2013 after the animal stock recovers naturally to its original numbers. As shown in Figure 6, which illustrates the chronological variation of the rainfall deficit effects, damage (represented by the value of dead animals) and production losses in crops as well as higher costs of production across sectors occurred in 2010 and 2011. The figure also shows that production losses in the livestock subsector would still occur in 2012 and 2013, although at much lower rates.

Figure 5: Sectoral distribution of damage and losses caused by 2010-2011 rainfall deficit
(billion Shillings)



Source: Analysis by Assessment Team.

Figure 6: Time distribution of effects of 2010-2011 rainfall deficit
(billion Shillings)



Source: Estimations by Assessment Team.

The structure of damage and losses, the affected sectors, and the time distribution of the effects in Uganda are typical of slow-evolving, drought-related events. In such events, nearly no destruction of physical, durable assets occurs, except for the death of cattle and other livestock. This phenomenon can be seen clearly in the database of disaster events kept at the Global Facility for Disaster Reduction and Recovery where more than 100 cases are listed, of which over one dozen are drought-related events.[8]

Rainfall Deficit and Poverty

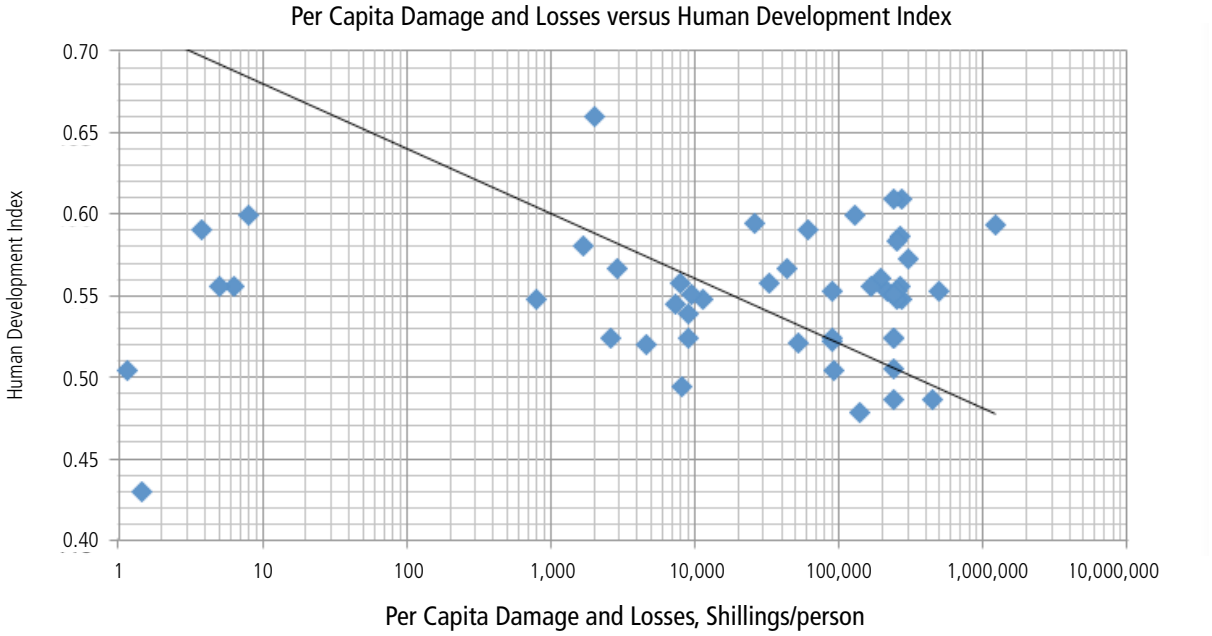
Notably, the most severe effects of the rainfall deficits occurred in districts with the lowest human development conditions. The damage and losses per capita described above were compared to the most recent values of the Human Development Index (HDI), as developed by the United Nations Development Programme (UNDP) in cooperation with the Government of Uganda. The comparison showed that, in general terms, the higher values of damage and losses occurred in districts where the HDI is lowest (Figure 7). In other words, the poor sustained the higher values of disaster effects. Such a finding points to the possibility that poverty may have been aggravated by the rainfall deficits, especially in those districts that were most affected. This may seem like an obvious conclusion but further analyses are needed to validate it.

B. Macroeconomic Impacts of the Rainfall Deficit

An external shock such as the rainfall deficit event may negatively affect macroeconomic aggregates such as GDP, the balance of payments, the fiscal sector, and inflation. The assessment used the estimated values of losses in production of goods and services as well

[8] See http://gfdrr.org/

Figure 7: Relationship between per capita damage and losses and Human Development Index in the affected districts



Source: Analysis by Assessment Team using official information.

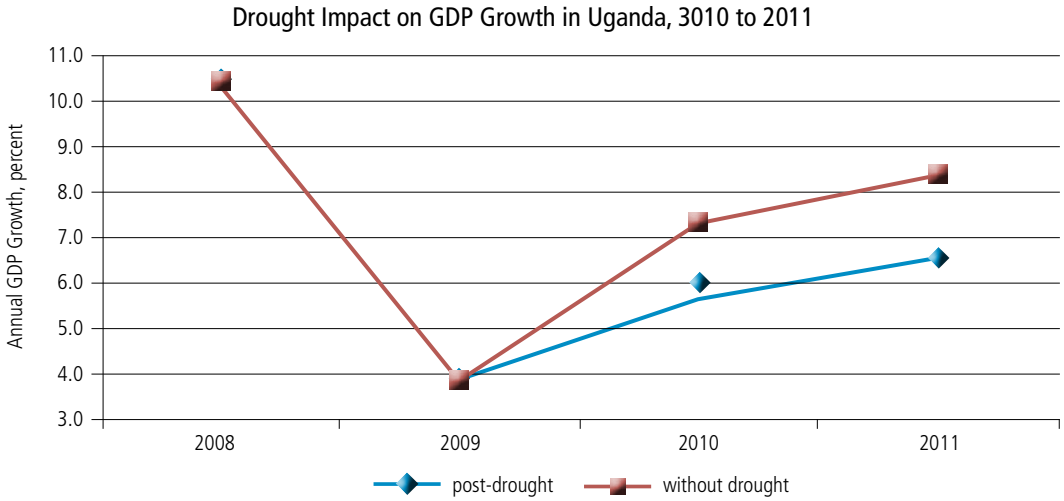
as the higher expenditures or costs in production to analyze how these aggregates may have been modified, applying the standard DaLA methodology. The baseline used was the performance of these variables in 2010—as already reported by the Uganda Bureau of Statistics (UBOS) and the Ministry of Finance—and the forecasted performance for year 2011, as foreseen at the beginning of 2011. Superimposing the estimated losses indicated how Uganda's economy would have performed if the rainfall deficit event had not occurred, providing a measurement of the negative impact of the event.

The assessment found that the losses caused by the rainfall deficits of 2010-2011 did produce impacts at the macroeconomic level. This section of the report describes the estimated impacts on the macroeconomic aggregates of Uganda—isolating them from other external and domestic factors that may affect overall economic performance. The analysis clearly shows that the rainfall deficit had a negative impact on economic performance, which suggests that risk reduction would be a definitive means by which to ensure sustainable development.

Impact on GDP Performance

The estimated impact of the rainfall deficit event, isolated from other external and domestic issues, was 1.8 percent in 2010 and 1.7 percent in 2011, or a combined figure of 3.5 percent of GDP growth for the two years. In other words, if the rainfall deficit had not occurred, the Ugandan economy would have grown by a combined 3.5 percent more in those two years, which is not insignificant. Figure 8 shows Uganda's GDP growth from 2008 to 2011 under two conditions: the line in red shows GDP performance as observed through 2010 and forecast for 2011, and the line in blue shows GDP performance in the absence of the rainfall deficit. Clearly, the production losses of goods and services in many sectors, combined with higher costs of production and higher prices for selected commodities due to scarcity and speculation, generated a measurable negative impact on the growth of the economy. The methodology used to calculate these impacts is described in Box 2.

Figure 8: Impact of the rainfall deficit event on GDP performance



Source: Estimations by Assessment Team.

Box 2: Calculating the impacts of the rainfall deficit event on Uganda's GDP

For the analysis, the value of production losses in all affected sectors and of higher costs of production and/or higher, unexpected expenditures incurred due to the rainfall deficit was converted into value added by using the technical coefficients that relate gross production to value added, as taken from the input/output table for Uganda available at UBOS. It was thus possible to eliminate intermediate consumption and possible double accounting in the analysis, which was conducted separately for 2010 and 2011.

For 2010, using the actual data on GDP, the estimated sectoral production losses and the higher costs incurred were introduced with negative or positive signs, using current values throughout. These values were then converted into constant 2002 values using the appropriate official deflators. The resulting, revised GDP was the value that would have occurred in the absence of the rainfall deficit event, and a revised annual growth rate was calculated for 2010 for comparison to the actual value that occurred.

For 2011, the forecasted value of GDP was used as baseline. The estimated sectoral production losses and higher production costs and expenditures were then converted into added value and subsequently inserted with positive and negative signs into the forecasted value of GDP. Again, conversions were made using the appropriate deflator to convert all figures into constant 2002 values. The resulting GDP is that which would have happened in Uganda in the absence of the rainfall deficit.

Impact on Balance of Payments

The estimated production losses and higher costs of production for the affected sectors had a negative impact on the exports and imports of goods. As mentioned above, the lower production of cash crops resulted in lower amounts of exports of goods such as sugar, coffee, tea and tobacco. In addition, the need to produce more electricity using thermal power plants as a substitute for hydroelectric production required higher fuel imports.

The assessment found that if the rainfall deficit event had not occurred, Uganda would have experienced a 2.5 percent improvement in its balance of payments in 2010 and a similar positive impact in 2011. Using the estimated losses in production and higher production costs from the assessment, the changes in

the amounts of exports and imports of goods for all affected sectors were calculated. These values were then inserted into the current account of the balance of trade for Uganda in 2010 and 2011, and the corresponding revised values of exports and imports and of the balance of trade were estimated. Table 6 shows the balance of trade after and without the impact of the rainfall deficit for 2010.

Table 6: Impact of rainfall deficit event on balance of trade in 2010, US$ millions

	After rainfall deficit	Estimated losses due to rainfall deficit	If no rainfall deficit had occurred
Exports	2,164.0	59.1	2,223.1
Imports	- 4,264.4	-22.3	-4,286.7
Balance of trade	-2,100.4		-2,063.6

Source: Estimations by Assessment Team.

Impact on Government Budget

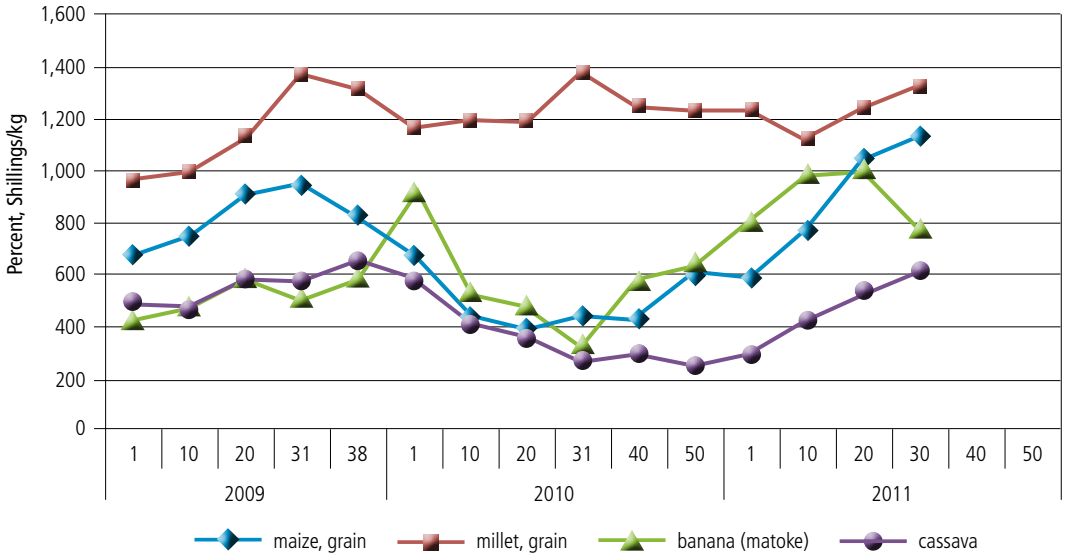
The assessment estimated that the current government deficit in 2010 would have been 7.5 percent lower and the expected surplus for 2011 would have been 7.1 percent higher if the rainfall deficit had not occurred. Using the sectoral results of the assessment, estimates were made of the lower tax revenues arising from the production losses in all affected sectors and of higher-than-normal expenditures to meet relief and other emerging needs from the rainfall deficit. Such expenditures included food and nutrition assistance, medical assistance, vector control costs, and other similar government disbursements. Superimposing such figures on the government budget yielded estimates of how the government deficit/surplus would have differed for 2010 and 2011 without the rainfall deficit (Table 7).

Table 7: Rainfall deficit impact on current tax revenues and expenditures of the government of Uganda in 2010-2011 (billion shillings)

	2010			2011		
	After rainfall deficit	Estimated losses	Without rainfall deficit	After rainfall deficit	Estimated losses	Without rainfall deficit
Tax revenues	5,114.2	16.4	5,130.6	6,260.0	64.9	6,324.9
Expenditures	5,736.4	30.2	5,706.2	4,961.5	27.3	4,934.2
Surplus/deficit	**-622.2**		**-575.6**	**1,298.5**		**1,390.8**

Source: Estimations by Assessment Team.

Figure 9: Trends in retail prices of selected basic foodstuffs, 2009 to mid-2011



Source: Worked out by the assessment team

Impact on Prices and Inflation

In addition to the impacts on macroeconomic variables described above, Uganda faced higher-than-normal prices of basic food products. These higher prices were caused directly by the scarcity brought about by domestic food production losses as well as indirectly by speculation from traders in view of the drought affecting neighboring countries. Figure 9 shows the trend in retail prices of selected basic foodstuffs from 2009 to mid-2011. Inflation in 2011 rose significantly due to these higher prices of foodstuffs, in addition to other factors.[9]

These price increases affected the country's urban and rural populations in different ways. Urban dwellers, especially those living in marginal areas, suffered more since they rely on local markets for their food purchases. Rural inhabitants who lost their subsistence crops and did not receive food assistance from the government also had to purchase food at higher prices. As noted above, farmers did not benefit from these high market prices.

[9] Quote from *The Independent* of 22 April 2011 – Louis Kasekende: "Headline inflation and core inflation rose to 11.1 percent and 7.8 percent in March 2011, from 6.4 percent and 6.0 percent in February 2011. Food crops inflation also followed a similar trend, increasing to 29.1 percent, up from 6.9 percent and 1.5 percent in February 2011 and January 2011, respectively. Energy, Fuel and Utilities (EFU) inflation also increased to 10.4 percent from 9.7 percent and 8.6 percent, respectively during the same period. This increase is reflective of the global prices trend, with potential for further increase."

Damages and Losses by Sector

SECTION III

A more detailed sector-by-sector analysis of damage and losses from the 2010-2011 rainfall deficit situation points to several key priority areas for recovery and reconstruction. This section presents the more detailed estimates of damage and losses in each sector as well as some selected subsectors, including brief descriptions of how the estimates were developed. These estimates were then used as the basis for calculating recovery and reconstruction needs in each sector, as presented in Section IV.

A. Agriculture

Overview of the Agriculture Sector and Contribution of Agriculture to the Economy

Agriculture is an extremely important sector for the people and economy of Uganda. According to the 2011 UBOS, agriculture accounts for about 21 percent of GDP (GDP in 2010 was 37.1 trillion Shillings); 46 percent of export earnings (total export earnings in 2009 were US$ 3.1 billion); and 66 percent of total employment (total population of Uganda in mid-2011 was 33 million). Coffee is the most important export crop. Manufacturing accounts for about 20 percent of GDP, and 40 percent of this is attributed to agro-industry, mainly food processing. Table 8 shows a breakdown of the contribution of agriculture to GDP.

Table 8: Contribution of agriculture to GDP by subsector, 2007-2010

	Percent Share			
Sub-sector	**2007**	**2008**	**2009**	**2010**
Cash crops	2.0	2.0	1.6	1.0
Food crops	11.0	11.9	14.0	12.1
Livestock	1.6	1.6	1.5	1.6
Forestry	3.5	3.5	3.3	3.6
Fishing	2.7	2.6	2.3	2.8
Agriculture	**20.7**	**21.6**	**22.8**	**21.1**

Source: 2010 and 2011 Statistical Abstracts, Uganda Bureau of Statistics.

Agriculture is the main contributor to achieving food security in the country. In 2009/2010, around 24.5 percent of the population (about 7.5 million) was below the poverty line. Most of the poor are in rural areas (85 percent of Uganda's total population is classified as rural). The main source of livelihood for the rural population is subsistence agriculture, including crops, livestock, and fisheries. At present, agriculture is performing substantially below its potential—in other words, the potential contribution of agriculture is likely to be even higher. Given the critical importance of agriculture, any proposed DRM strategy should deal with cash crops, food crops, and livestock. Agriculture also provides the necessary raw materials for agro-industry.

Sources of Growth in Agricultural Production

Agricultural growth in Uganda was impressive up to year 2000/01 when it was 7.9 percent per year, but the growth rate has gradually declined since then, due in part to recurrent droughts. However, as shown in Table 9, the relative performance in terms of annual growth rates varies by agricultural subsector and the year in question.

Table 9: Composition of growth in the agriculture sector, 2004-2009

	Growth Rate (%)					
Subsector	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Cash crops	7.3	-5.5	-10.6	5.4	9.0	1.7
Food crops	-1.5	-0.2	-0.1	-0.9	2.4	2.9
Livestock	4.7	3.0	1.6	3.0	3.0	3.0
Fisheries	9.6	13.5	5.6	-3.0	-11.8	-0.1
Forestry	–	6.5	4.1	2.0	2.8	3.2
Agriculture	**1.6**	**2.0**	**0.5**	**0.1**	**1.3**	**2.6**

Source: MAAIF, Development Strategy and Investment Plan (2010/11 – 2014/15), January 2010.

Many factors have contributed to this poor performance and sources of growth in the agricultural sector: climate change and natural disasters (droughts, floods, and landslides), disease and pests, low agricultural productivity, and high losses (both during harvest and post-harvest). Agricultural productivity is low (one-fourth to one-half of the potential) due to rainfall variability, soils with depleted nutrients, and low soil moisture holding capacity. The use of modern agricultural inputs is very low, as well. For example, average fertilizer use in Uganda is about 1 kg/ha, compared to 31 kg/ha in neighboring Kenya. Furthermore, according to the Development Strategy and Investment Plan (DSIP), the share of farmers using modern agricultural inputs is 6.3 percent for improved seeds, 6.8 percent for manure, 1 percent for chemical fertilizers, and 3.4 percent for herbicides, fungicides, and pesticides.

Structure of the Agricultural Sector

A brief summary of each of the agricultural subsectors in Uganda is provided below.

Cash Crops

The main cash crops in Uganda are coffee, tea, cocoa, tobacco, and cotton, with coffee being the dominant cash and export crop. Annual variations in production are high and are mainly due to rainfall variability. Table 10 shows the procurement levels (which are almost equal to production, according to the UBOS) of cash crops in Uganda.

Table 10: Production of Uganda's cash crops in tons

	Procurement/Production ('000 ton)			
Crop	2007	2008	2009	2010
Coffee Robusta	144	187	154	122
Coffee Arabica	31	31	42	46
Coffee Total	175	219	196	168
Tea	45	46	49	49
Tobacco	26	29	19	28
Cocoa	10	13	15	?
Cotton	1	23	13	?

Source: Uganda Bureau of Statistics.

Food Crops

Table 11: Data on the area, production, and yield for food crops in Uganda in 2010, according to type of crop

Crop Groups	Crops	Area ('000 ha)	Production ('000 ton)	Yield (kg/ha)
Cereals	Millet	167	268	1,605
	Maize	1,032	2,374	2,300
	Sorghum	355	391	1,101
	Rice	87	218	2,506
	Wheat	12	20	1,667
Root crops	Sweet Potatoes	442	1,987	4,495
	Potatoes	36	187	5,194
	Cassava	794	3,017	3,800
Pulses	Beans	633	949	1,499
	Field Peas	28	17	607
	Cow Peas	24	12	500
	Pigeon Peas	32	13	406
Others	Groundnut	394	276	701
	Soybean	75	27	360
	Sim Sim	198	119	601
	Sun Flower	195	234	1,200

Source: 2011 Statistical Abstract.

Uganda is considered the bread basket for East Africa since, in addition to cash crops, some food crops are also exported to neighboring countries. Despite the fact that Uganda is a bread basket, food prices have doubled and tripled for some food crops in the past two years due to expanding demand, particularly from South Sudan and Kenya. To some extent, an increase in food prices in Uganda is the direct impact of drought in the Horn of Africa. These prices are good for those farmers who have a marketable surplus but not for those who are net buyers in rural areas or urban consumers. Since the marketing system for food crops is not well organized, high international food prices oftentimes are not reflected in high farm gate prices. Food crop traders and intermediaries are the main beneficiaries of high food prices.

Livestock

Livestock is a very important subsector for the pastoralists, farmers, and the Ugandan economy. The cattle corridor and the Karamoja subregion (about 39 districts) are the most important areas for livestock production in Uganda. These districts are also the most drought-prone in the country. Based on the 2008 Livestock Census in Uganda, the regional distribution of different categories of livestock is provided in Table 12.

Cattle and goats account for the largest share of livestock in Uganda. With the exception of pigs and poultry, Uganda's Northern region accounts for the largest share of cattle, goats, and sheep. Within the Northern region, the Karamoja sub-region accounts for the largest number of animals. Most of the remaining livestock is found in the cattle corridor.

Notably, both the Karamoja sub-region and the cattle corridor also consist of the most drought-prone districts in the country. Drought adversely affects animal health, animal productivity, production of grass on the pastures, and availability of water for drinking.

Table 12: Regional distribution of livestock in Uganda

Region	Regional Share for Livestock (%)					Population (%)
	Cattle	Goats	Sheep	Pigs	Poultry	
Central	22	14	8	41	28	29
Eastern	22	21	9	22	29	25
Northern	34	37	66	13	24	20
Western	22	28	17	24	19	26
Total	100	100	100	100	100	100
Uganda (2008): million	11.4	12.3	3.4	3.2	37.4	30
Uganda (2009): million	11.8	12.8	3.5	3.3	38.6	31
Uganda (2010): million	12.1	13.2	3.6	3.4	39.8	32

Source: Uganda Statistics Abstracts, 2010 and 2011.

Impact of the Rainfall Deficit on the Agriculture Sector

Damage and losses in the agriculture sector were estimated at 2.2 trillion Shillings or approximately US$ 907.0 million, accounting for 77 percent of total damage and losses across all economic sectors. The damage and losses for agriculture due to drought can be summarized as follows: (i) damage due to animal deaths accounted for 5 percent of the total damage and losses for agriculture, and the remaining 95 percent were losses; (ii) crops accounted for 48 percent of the total damage and losses while livestock accounted for 52 percent; (iii) within crops, 88 percent of the production losses were attributed to food crops and 12 percent to cash crops; (iv) within livestock, 83 percent of the damage and losses for livestock was attributed to production losses, 9 percent was due to damage due to animal deaths, and the remaining 8 percent was due to higher production costs; and (v) the timeline distribution of damage and losses for agriculture was 30 percent in 2010, 54 percent in 2011, 5 percent in 2012, and 3 percent in 2013. Damage and losses by subsector are discussed below.

Table 13: Estimated damage and losses for agriculture in Uganda

Subsector	Impact	Damage and losses (million Shillings)				
		2010	2011	2012	2013	Total
Crops	Losses: production	574,250	460,479	–	–	1,034,729
Livestock	Damage: deaths	39,608	66,596	–	–	106,204
	Losses: production	256,755	590,778	52,248	35,097	934,858
	Losses: higher production costs	41,274	44,130	–	–	85,404
	Subtotal	337,637	701,504	52,248	35,097	1,126,466
Agriculture	**Total**	**911,887**	**1,161,983**	**52,248**	**35,097**	**2,161,195**

Source: Assessment Team estimates.

Food Crops

In the food crop subsector,[10] the rainfall deficits resulted in production losses amounting to 911.8 million Shillings,[11] representing about 42.2 percent of total losses in the agricultural sector. Rainfall was insufficient to meet crop water requirements from 37 to 66 percent of the time in 2010 and 2011. This covers up to three food crop seasons in some districts—two in 2010 and one in 2011.[12] Food crops were greatly affected by the drought since most of them are annual in nature and depend greatly on the seasonal availability of rains. All the crops in this category are purely rain-fed, and any absence of rains directly translates into either their destruction or reduced production and productivity. Table 14 shows the level of production losses per crop. The losses vary by district, but all the losses were in the private sector.

The losses also indicate the relative importance of the crop in the food basket, with bananas being most important, followed by maize, beans, groundnuts, cassava, and sweet potatoes in decreasing order. The high figure for pineapples can be attributed to their value in terms of price and their fragility in production, as water forms the main content of the fruit. The amount of losses in terms of magnitude for the main food crops is illustrated in Figure 10.

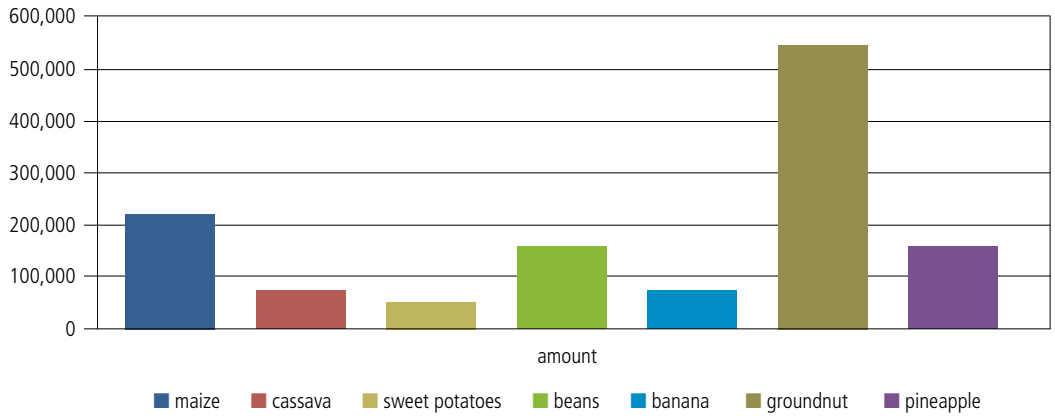
Table 14: Production losses in the food crop subsector in 39[13] districts (million Shs.)

Crops	2010	2011	Total
Maize	181,771	94,649	276,420
Sorghum	21,171	13,609	34,780
Millet	5,432	4,043	9,474
Rice	1,216	16,050	17,266
Cassava	69,791	63,353	133,144
Sweet Potatoes	44,820	51,328	96,148
Beans	156,776	54,042	210,818
Soybeans	143	105	248
Cow peas	218	2,028	2,246
Groundnut	68,888	64,580	133,468
Sunflower	837	322	1,159
Banana	418,637	176,789	595,426
Pineapple	150,725	58,843	209,568
Total (Million Shs.)	1,120,424	599,741	1,720,165
Total (US$ Million)[14]	**470.2**	**251.7**	**721.9**

Source: Computed by the Assessment Team.

[10] The main food crops included in the impact assessment were cereals, root crops, pulses, oil seed, and fruits. Most of these crops are grown in almost all the districts by smallholder farmers.
[11] The figure is a percentage of the estimated loss in the sector down from 1,720.2 billion shillings that is attributed to the drought.
[12] In Uganda, there are two crop seasons in a year: the minor season (spring and early summer) and the major season (summer, fall, and winter). As part of this assessment, production losses were estimated for two seasons in 2010 (major and minor) and one crop season in 2011 (minor).
[13] The 39 districts comprised the study sample for the analysis.
[14] The exchange rate used was UGX 2,382.75 per US$ 1, the average rate for 2010 and 2011.

Figure 10: Losses among the main food crops



Although rice is important as an institutional food, it fails to be included in the traditional group and hence is limited in consumption following its limited scale in production. The lower losses relate to the fact that rice is grown mainly in wetlands, except for a small amount of upland rice, which may account for most of the losses recorded. The country still records significant amounts of rice imports to supplement domestic consumption. Although rice production in Uganda increased from 120,000 metric tons in 2002 to 200,000 metric tons in 2010, saving Uganda over US$ 50 million annually on rice importations, net rice imports are still estimated at about 60,000 metric tons (CARD, 2010).

Uganda's role as the food basket of the eastern part of Africa and the Great Lakes region not only justifies a speedy recovery and reconstruction program but also drought disaster risk reduction to protect the food sector. Recovery and reconstruction measures should address the relative importance of the crops to restore the food balance in the country and region as a whole, otherwise the welfare of the population may be put at risk. It is also important to note that the foods are consumed by Ugandans almost evenly given the cultural mix, and most of the crops are sources of food used by institutions such as schools and other training institutions.

Cash Crops

Cash crop yields were negatively affected, which had a carry-over effect on the food processing industry sectors as well as on Uganda's exports. Overall, the cash crop subsector sustained an estimated 123.0 billion Shillings in production losses as a result of the 2010-2011 rainfall deficits. The assessment examined the effects of the rainfall deficits on the cash crop subsectors of sugarcane, coffee, and tea and tobacco in greater detail, as described below.

Sugarcane

The analysis utilized detailed information on sugarcane and sugar production obtained from the three main producers and manufacturers of these products in Uganda, including the Lugazi-based Sugar Corporation of Uganda, Kinyara Sugar Limited, and Kakira Sugar enterprise. The collected historical production data is summarized in Table 15. The discussion in this section focuses on the results of production losses of sugarcane, while losses associated with sugar processing and exports are discussed and accounted for under the industry sector, where these activities are normally included in the national accounts of the country.

Table 15: Production and productivity of sugarcane and sugar in Uganda, 2004 to 2010

	2004	2005	2006	2007	2008	2009	2010
Sugarcane production, tons	2,202,876	2,350,000*	2,250,071	2,222,765	2,635,407	3,020,668	3,222,581
Sugarcane yield, tons/ha	93.30	95.9	94.60	92.80	85.40	84.10	82.40
Sugarcane area, ha	23,610	24,500	23,785	23,952	30,860	35,918	39,109
Sugar production, tons	196,116	193,728	191,256	194,868	235,825	284,886	297,016
Sugar to cane ratio, %	8.90	9.00	8.50	8.77	8.95	9.43	9.22
Cane age at harvest, months	19.3	…	17.8	18.6	17.3	17.3	16.8

Notes: * Information taken from FAO (http: //www.faostat.org/)
Source: Uganda Sugarcane Technologists Association (USCTA).

During the latter part of 2010 and the first half of 2011, sugarcane-planted areas were affected by lower-than-average monthly rainfall and other difficult conditions. During this period, monthly rainfall in the sugarcane-planted areas was lower than average and the onset of the normal rainy season was delayed. Furthermore, an arson fire that was very difficult to control due to higher-than-normal air temperatures, strong winds, and very low humidity conditions destroyed about 3,000 hectares of cane. As a result, production and productivity of sugarcane were lower than normal (down to 60 tons per hectare), and the sugar-to-cane ratio was also down to levels similar to those in 2006.

The assessment estimated that sugarcane growers lost a total of 10.5 billion Shillings in 2010 and 2011 as a result of the rainfall deficits (Table 16). Losses to cane producers due to the arson fires in 2011 had an additional estimated value of 16.1 billion Shillings, in addition to the damage value of the plantation. If the fire had been started during a normal weather year—with higher air humidity content, lower air temperature, and less strong wind conditions—the losses would have been smaller. Therefore, at least part of the losses caused by the fires may be attributed to the rainfall deficit that affected Uganda in 2010 and 2011.

Table 16: Estimation of production losses in sugarcane due to rainfall deficits, 2010 to 2011

	2010	2011	Total
Forecast without rainfall deficit			
Harvested area, hectares	39,109	29,444*	
Average yield, ton/hectare	84.1	84.1	
Production, tons	3,289,028	2,476,278	
Forecast after rainfall deficit			
Harvested area, hectares	39,109	29,444	
Average yield, ton/hectare	82.4	80.7**	
Production, tons	3,222,551	2,376,114	
Sugarcane production losses, tons	66,485	100,097	166,574
Farm-gate price, Sh/ton	57,620	66,560	
Value of losses, million Shillings	**3,830.4**	**6,662.5**	**10,492.9**

Notes: *After deducting 3,000 hectares that were destroyed by arson fire, although the extent of the fire resulted from the same meteorological phenomenon. **Estimated average yield after rain deficit in 2011.
Source: Estimations by Assessment Team based on data provided by USCTA.

Coffee

Detailed information on production, harvested areas, and prices of coffee was obtained from the Uganda Coffee Development Authority (UCDA). Discussions were held with UCDA officials on the performance of the subsector over the past ten years, with special reference to the production and productivity of the product during rainfall-deficit years. This information is summarized in Table 17.

Table 17: Procurement and exports of coffee varieties, 2004 to 2010

	2004	2005	2006	2007	2008	2009	2010
Procurement of coffee, tons	170,081	158,100	133,110	175,346	211,762	195,871	167,952
Robusta	138,068	122,489	96,490	144,109	187,405	153,822	122,299
Arabica	31,993	35,611	36,620	31,237	31,376	42,049	45,653
*Coffee exports, 60-kg bags**							
Robusta	1,998,360	1,408,314	2,144,482	2,713,498	2,405,137	1,957,400	…
Arabica	516,530	594,010	559,754	497,105	648,551	711,571	…
Coffee exports							
Quantity, tons	159,983	142,513	126,887	164,540	200,640	181,324	159,433
Value, thousand US$	124,237	172,942	189,830	265,853	403,179	280,209	283,891
Average annual export price, US$/kilogram	0.78	1.21	1.50	1.62	2.01	1.55	1.78

Notes: *Annual coffee exports cover from October of the first year to September in the following year, as provided in UCDA statistics.
Source: Uganda Bureau of Statistics (UBOS) and Uganda Coffee Development Authority (UCDA).

A comparison of annual coffee production with annual and monthly rainfall rates in the coffee-growing areas of Uganda reveals that this product is very sensitive to changes in rainfall availability. Since coffee production is under rain-fed conditions in Uganda, with little if any irrigation, any lower-than-normal rainfall at the time of coffee flowering would have a negative impact on the crop yields. Furthermore, coffee growers would normally shift their attention to food procurement at the same time when rainfall deficits occur and would pay less attention to harvesting of the coffee crop. In addition, over the years, urban expansion has resulted in a progressive reduction of coffee-planted area, the volatility of international prices has encouraged coffee growers to shift into other crops, and in general the labor force has shifted into better-paying activities in urban areas.

Production of the Robusta variety was more affected than production of the Arabica variety, due in part to differences in moisture requirements. Another reason is that—at least since 2002, when a detailed baseline survey was undertaken—nearly 44.5 percent of Robusta plants have been affected by Coffee Wilt Disease. Furthermore, the plantations are very old (trees more than 50 years in age) and thus are beyond their prime in productivity terms. Thus, Robusta coffee production and yields experienced significant declines after the 2005-2007 drought event and then also after 2008, with a marked decline in 2010 and possibly more in 2011. Impacts on the Arabica variety seem less pronounced and also delayed by as much as two years, at least after the 2005-2007 drought.

The analysis found that the value of Robusta coffee production lost by growers due to the rainfall deficit months in 2010 and 2011 was approximately 97.75 billion Shillings (Table 18). To estimate production losses in 2010, the production obtained in 2009 was compared with the actual quantity obtained in 2010, after the rainfall deficit had occurred. To estimate production in 2011, a projection was made based on the production obtained in 2010 and following the same trend in production decline observed during the 2005-2007 drought. The values of the losses were estimated based on the domestic unit prices paid to coffee growers in June of each calendar year.

Table 18: Production losses in Robusta coffee due to rainfall deficits, 2010-2011 estimations

	2010	2011	Total
Production, tons			
Without rainfall deficit	153,822	122,299	
After rainfall deficit	122,299	94,081	
Estimated production loss, tons	31,522	28,218	
Unit prices			
Coffee growers, Shilling/kg	1,400	1,900	
Value of losses to coffee growers, million Shillings	**44,132.0**	**53,614.7**	**97,746.9**

Source: Estimations by Assessment Team based on data provided by UBOS and UCDA.

Tea and Tobacco

The analysis used data on production, exports, and prices for tea and tobacco, covering the period from 2004 to 2010. This information was obtained from the Uganda Bureau of Statistics, the Uganda Tea Authority, and private tobacco enterprises. The key data, summarized in Table 19, provides evidence of a correlation between rainfall availability and the total production and productivity of these two commodities.

Table 19: Production, exports, and average export price of tea and tobacco, 2004 to 2010

	2004	2005	2006	2007	2008	2009	2010
Production, tons							
Tea	35,706	37,734	34,334	44,923	45,680	48,663	49,182
Tobacco	32,520	23,730	15,793	26,383	29,040	18,846	27,165
Average price paid to farmers, Sh/kg							
Tea	180	180	180	200	220	220	240
Tobacco	1,350	1,110	1,586	1,872	1,858	1,865	1,862
Export quantity, tons							
Tea	36,874	36,532	30,584	44,015	46,022	44,446	54,555
Tobacco	27,843	23,730	15,794	26,384	29,042	32,000	32,373
Export value, thousand US$							
Tea	37,528	34,274	50,873	47,629	47,222	59,761	68,263
Tobacco	40,702	31,485	26,924	66,301	66,448	57,170	68,662
Average export price, US$/kg							
Tea	1.02	0.94	1.66	1.08	1.03	1.34	1.25
Tobacco	1.46	1.33	1.70	2.51	2.29	1.79	2.12

Source: Uganda Bureau of Statistics, Uganda Tea Authority.

Production losses to the growers of tea and tobacco in 2011 were estimated at 1.1 and 13.7 billion Shillings, respectively (Table 20). Tea and tobacco plantations are sensitive to the temporary unavailability of water for their growth and respond through lower unit yields and quality of the harvested product. For the assessment, the production losses that occurred at the time of the 2005-2007 drought were analyzed, and a trend of annual production decline was derived for both tea and tobacco. This trend (9 percent production decline in the case of tea, 27 percent in the case of tobacco) was applied to the actual production quantity that occurred in 2010 to estimate the projected production in 2011 and the corresponding losses for the year. Unit prices prevailing in 2010 were adopted to estimate the corresponding monetary losses to the producers of the two products in 2011.

Table 20: Estimation of production losses in tea and tobacco due to rainfall deficits, 2010 to 2011

	2010	2011
Production, tons		
Tea	49,182	44,750*
Tobacco	27,165	18,951**
Estimated production loss, tons		
Tea		4,432
Tobacco		8,214
Producer prices, Shilling/Kg		
Tea	240	240
Tobacco	1,862	1862
Export prices, US$/Kg		
Tea	1.25	1.25
Tobacco	2.12	2.12
Value of production loss, million Shilling		
Tea		1,063.9
Tobacco		13,671.9

Notes: *assuming a 9 percent decline in previous year's production, based on previous rainfall deficit year; **assuming a 30 percent decline in previous year's production, based on previous rainfall deficit years.

Source: Estimations by the Assessment Team based on data provided by UBOS, Uganda Tea Authority, and other private sources.

Livestock

Following the food crop subsector, the livestock subsector was the most affected by the rainfall deficit situation in 2010-2011.[15] Livestock husbandry is a very important enterprise in Uganda, particularly in the cattle corridor and the Karamoja region where almost all the drought-prone districts in Uganda are located. As described earlier, scarcity of water and feed caused loss of animal weight and milk production which, combined with disease acquired when traveling long distances to find water and feed, resulted in production losses in meat and milk. The production losses are expected to continue—albeit at much lower rates—until the animal stock recovers in 2013.

The total damage and loss for livestock is estimated to be 1,126,466 million shillings or 52 percent of the total damage and loss for agriculture. The livestock subsector sustained damage amounting to 106.2 billion Shillings in value and losses amounting to 1.0 trillion Shillings in value. Within the livestock subsector, 83 percent was due to production losses (milk and meat), 9 percent was due to damage caused by animal deaths, and the remaining 8 percent was due to an increase in production costs. Most of the damage and losses related to livestock were in the Karamoja region, and almost all were in the private sector since all livestock owners and pastoralists are private entrepreneurs. Most of the pastoralists and livestock farmers are also very poor, with very low per capita annual household income. Table 21 presents a breakdown of total production losses in the livestock sector according to the different sources of the loss, which are important to consider in formulating recovery strategies.

[15] The rainfall deficit impact assessment for livestock dealt with three types of animals: cattle, goats, and sheep.

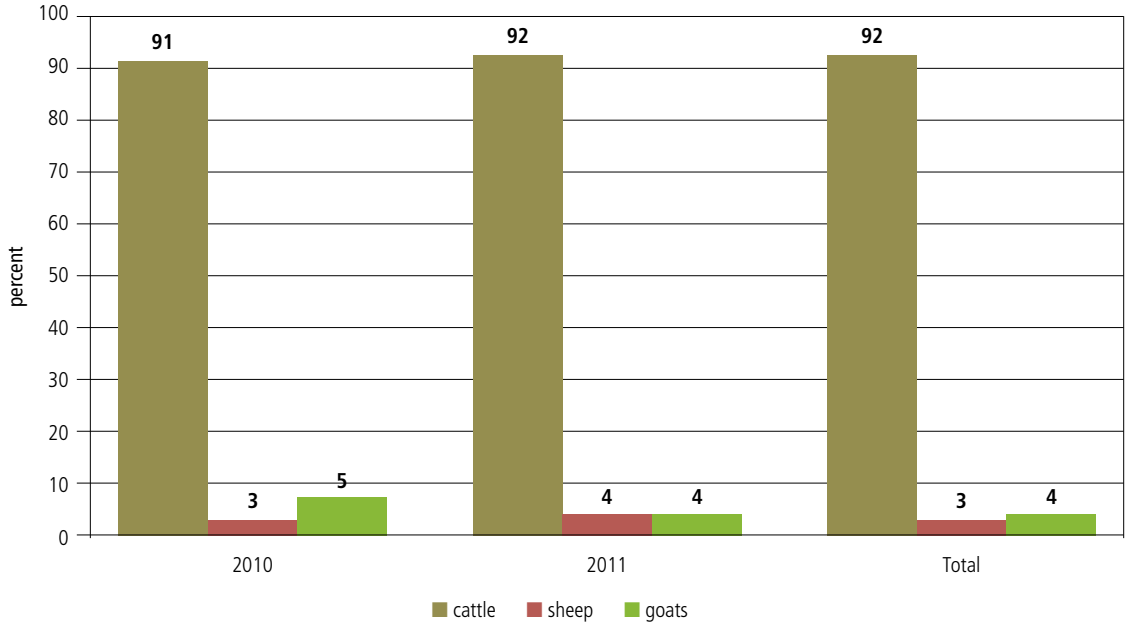
Table 21: Production losses in the livestock subsector for 39 districts (million Shillings)

Source of Loss	2010	2011	2012	2013	Total
Loss due to death	17,151	52,248	52,248	35,097	156,744
Loss due to sickness	239,604	538,530			778,134
Total production losses	**256,755**	**590,778**	**52,248**	**35,097**	**934,878**
Higher vet costs	11,388	9,045			20,433
Higher feed costs	15,750	17,934			33,684
Higher water costs	14,136	17,151			31,287
Total higher production costs	**41,274**	**44,130**			**85,404**
Total production losses (million Shillings)	**298,029**	**634,908**	**52,248**	**35,097**	**1,020,282**
Total production losses (million US$)	**125**	**266**	**22**	**15**	**428**

Source: Compiled by Assessment Team.

Cattle constituted over 90 percent of damage and losses to the sector, indicating the relative vulnerability of different types of livestock (Figure 11). Sheep and goats tend to show greater resilience to drought conditions, given their lower water demands. Damage could also arise out of diseases contracted from contact with affected animals and failure to access forage during drought. All of these factors need to be addressed in the reconstruction strategies so as to have the sector "built back better."

Figure 11: The percentage distribution of damage among livestock



B. Agro-Industry

As a result of primary production losses in the agriculture sector, the agro-industry sector sustained further production or processing losses. While industrial capacity was not affected directly, the availability of agricultural products for processing diminished. The production losses, which were estimated with the cooperation of millers and other processing industrialists, amounted to approximately 278.0 billion Shillings in value. Agro-industry losses are summarized in Table 22 and described in greater detail below.

Table 22: Agro-industry losses (million Shillings)

Industry	2010	2011	Total
Sugar processing	10,283.8	97,644.6	107,928.5
Coffee processing	44,132.2	77,600.2	121,732.4
Tea		10,175.3	10,175.3
Tobacco		17,910.7	17,910.7
Grain processing	12,472.7	7,744.7	20,217.4
Total	**68,898.8**	**213,086.5**	**277,964.3**

Source: Compiled by Assessment Team.

Sugar Processing

Losses in sugarcane production affected the subsequent processing activities correspondingly. In one of the mills in one of the enterprises, sugar-milling activities were stopped for two months, and two more months of stoppage were expected before the end of the year. In addition, energy production from bagasse (fibrous biomass waste that remains after sugar canes are crushed) making it necessary for the sugar mills to purchase electricity rather than exporting it to the national electrical gri16 causing sugar production costs to increase.

The analysis estimated that 107.9 billion Shillings were lost in 2010 and 2011 due to the non-processing of sugar, and approximately 20.5 billion Shillings were not collected from value added tax by the government due to the production losses (Table 23). Sugar processing losses were estimated using the sugarcane production decline taken from the cash crops section of this report, combined with the resulting sugar-to-cane ratios for 2010 and 2011. Prices paid for the sugar at ex-factory level were collected, and the annual values of sugar processing were estimated. Losses in tax revenues not collected by the government due to the sugar processing losses were also calculated.

Table 23: Estimation of losses in sugar processing due to rainfall deficits, 2010 to 2011

	2010	2011	Total
Sugarcane production losses, tons	66,485	100,097	166,574
Sugar-to-cane ratio, %	9.2	8.5	
Sugar processing losses, tons	6,128	52,793	
Ex-factory sugar price, Sh/ton	1,678,240	1,849,580	
Export sugar price, US$/ton	491	750	
Sugar-processing losses, million Shillings	**10,283.8**	**97,644.6**	**107,928.5**
Tax revenue losses, million Shillings	**1,953.9**	**18,552.5**	**20,506.4**

Source: Estimations by Assessment Team based on data provided by USCTA.

[16] Losses associated with the parallel rise in energy production costs are covered in the electricity sector section of the report.

As mentioned above, the millers have incurred other losses due to the corresponding decline in bagasse availability to generate electricity. An analysis of bagasse electricity generation reveals that in 2010 and the first six months of 2011, a total of 20.6 million KWh were not generated at the bagasse generating units owned by the Kinyara and Kakira sugar mills, when compared to the generation in 2009. Using the average cost of electricity (184.8 Shillings per KWh), these enterprises have incurred an estimated revenue loss of 3.84 billion Shillings (Table 24). The mills normally sell their electricity to the Uganda Electricity Transmission Company Limited (UETCL) which operates the national power system and which was forced instead to purchase electricity from other, higher unit cost sources of electricity as described in the section on the power sector. To avoid double accounting, these losses are not included in this sector but in the general sector of electricity generation.

Table 24: Estimated revenue losses in bagasse electricity generation, 2010 to 2011

	Bagasse electricity generation, million KWh			Electricity generation losses, million KWh			
	Normal year	2010	2011 (to June)	2010	2011	Total	Monetary loss, million Shillings
Kakira	88.3	80.3	30.2	8.3	10.2	18.5	3,410.5
Kinyara	5.0	4.8	0.9	0.2	2.2	2.4	434.1
Total	**93.3**	**85.1**	**31.1**	**11.5**	**12.4**	**20.9**	**3,844.6**

Source: Estimations by Assessment Team based on information provided by USCTA and UETCL.

Coffee processing

The estimated net losses to Robusta coffee processing operators amounted to 44.1 billion Shillings in 2010 and to a further 77.6 billion Shillings in 2011, or a total of 121.7 billion Shillings for the two-year period. The analysis utilized the estimated quantities of production losses sustained by the growers (detailed in the cash crop discussion above) to estimate the corresponding losses in the processing process of the Robusta coffee variety. These quantities of production lost were combined with the difference in unit prices paid ex-coffee-factory and the prices paid to growers (farm-gate levels), and the value of processing losses were calculated (Table 25). Since most of the production is exported abroad, the impact on the country's balance of payments will be significant.

Table 25: Estimation of losses in coffee processing due to rainfall deficits, 2010 to 2011

	2010	2011	Total
Robusta coffee production losses, tons	**31,522**	**28,218**	
Unit prices, Sh/kg			
Farm-gate	1,400	1,900	
Ex-factory	2,800	4,650	
Robusta coffee processing losses, million Shillings	**44,132.2**	**77,600.2**	**121,732.4**

Source: Estimations by Assessment Team based on data provided by UCDA and UBOS.

Tea and tobacco processing

The assessment found that processing losses occurred only in 2011—in 2010, they were of only minimal magnitude—at 10.2 billion Shillings for the tea industry and 17.9 billion Shillings for the tobacco industry. Similar to the analysis for the coffee processing industry, the production information described in the earlier section on cash crops was used to estimate the subsequent processing losses of both tea and tobacco. Primary production losses were combined with the unit prices of these products paid to growers and ex-factory, in order to calculate the net losses sustained in the processing factories (Table 26). Again, since most of the processed products are exported abroad, these losses will have a significant impact on the country's balance of payments.

Table 26: Losses in tea and tobacco processing due to rainfall deficits, 2010 -2011

	2010	2011	Total
Primary production losses, tons			
Tea	…	4,432	
Tobacco	…	7,343	
Grower (farm-gate) prices, Sh/kg			
Tea	240	240	
Tobacco	1,865	1,862	
Ex-factory prices, Sh/kg			
Tea	2,536	2,536	
Tobacco	4,301	4,301	
Net processing losses, million Shillings			
Tea	…	10,175.3	10,175.3
Tobacco	…	17,910.7	17,910.7

Source: Estimations by Assessment Team based on data provided by UBOS, Uganda Tea Authority, and other private sources.

Grains processing

Due to data constraints, the assessment had to adopt an indirect approach to estimating losses in this subsector. Sufficiently detailed data was not available on volumes and costs of processing different grains produced in the affected districts, so another approach was used for the estimation. First, the unit prices paid for each type of grain at the primary producer or farm-gate level and the average wholesale prices ex-factory after processing were analyzed. The latter was obtained from a private market survey information service for the period from 2007 to 2011,[17] while farm-gate prices were obtained directly from district officials. Second, it was assumed that the difference between wholesale and farm-gate prices for each of the processed grains was equivalent to the added value obtained during processing. Third, estimates were made of the quantities of each crop that would not be processed at the mills in 2010 and 2011—essentially discounting from the calculations the quantities of product that are used for self-consumption by the farmers—due to the grain production losses sustained in the affected districts. The total value of grains not processed due to the 2010-2011 rainfall deficits was estimated at 20,217.4 million Shillings.

C. Commerce

Losses in the commerce sector were estimated at 169.9 billion Shillings. The losses sustained in the processing of sugar, coffee, and tea and tobacco had a negative impact on Uganda's exports and balance of payments in both 2010 and 2011. The commerce

[17] See Market Information Service, *Wholesale and retail prices*, Farmga in Africa Limited.

or trade sector was only indirectly affected by the drought, with two factors affecting trade activities: a lower quantity of agricultural goods were sold in view of the production losses in those sectors, and prices of the same goods increased due to scarcity and speculation. Based on the estimated losses in the processing of agriculture products—including food and cash crops as well as livestock byproducts, as described earlier—and on the typical added value involved in the sale of these products, the lower sales of the sector were estimated at 39.2 billion Shillings in 2010 and 2011. It was further estimated that gains of 130.7 billion Shillings were obtained by the traders due to the higher unit prices of those products in the two years. Total losses for the commerce sector were thus estimated as 169.9 billion Shillings in 2010 and 2011.

D. Electricity

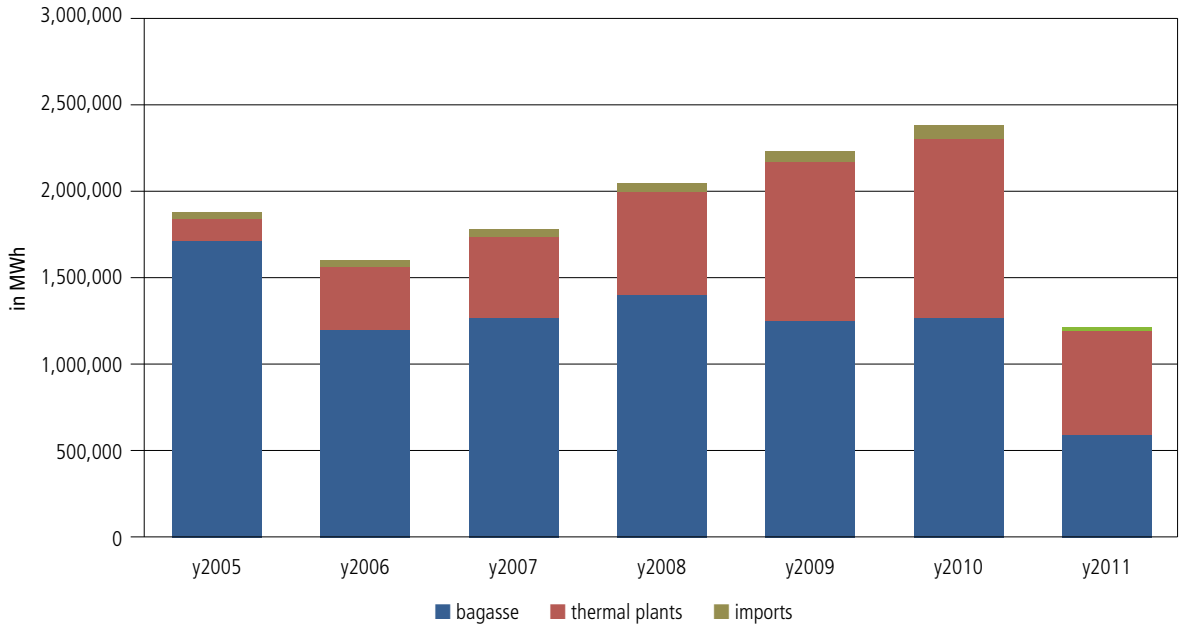
Since the 2005-2007 drought, Uganda has been unable to increase hydropower production and has relied more on thermal power to meet its growing electricity needs. In 2005, electricity was generated mainly at hydropower plants operated by Eskom and other minor producers (91.4 percent of the total), compared to electricity from thermal power plants (7.4 percent) and some minor imports from neighboring countries (1.3 percent). The following year, lower-than-normal rainfall and overproduction at the hydropower plants in Lake Victoria made it necessary to cut hydropower generation drastically. The share of hydropower generation continued to decline, accounting for 56 percent of total generation in 2009 while the share of thermal power generation increased to 40 percent. Sugarcane bagasse generation—which over the years eventually substituted for most electricity imports—reached a share of almost 4 percent (Table 27 and Figure 12).

Table 27: Electricity generation purchases in Uganda, by source of generation, 2005 to 2011

	Annual electricity generation purchases, Megawatt-hours				
Year	Hydropower	Thermal power	Imports	Bagasse	Total
2005	1,719,797	140,304	24,177		1,884,278
2006	1,190,477	369,499	49,027		1,609,003
2007	1,293,969	443,957	59,853		1,797,779
2008	1,404,400	585,800		54,500	2,044,700
2009	1,264,622	896,958		87,585	2,249,165
2010	1,280,573	1,023,894		85,116	2,389,583
To June 2011	603,672	589,045		31,142	1,223,859

Source: UETCL.

Figure 12: Electricity generation by source in Uganda, 2005 to 2011, in MWh



Source: Assessment Team using data provided by UETCL.

The rainfall deficits in 2010 and 2011 placed a large strain on Uganda's electricity system. Rainfall in 2010 was reported as slightly below average for the Lake Victoria basin due to the drought conditions in most of the Horn of Africa region. The second half of the year brought heavy rains that were insufficient for the lake to recover to normal levels, especially due to overproduction of hydropower in previous months. Following the long-standing agreement among Uganda, Tanzania, and Kenya for the utilization of Lake Victoria, the two large power stations at Kira and Nalubaale must limit water discharges at 700 cubic meters per second (*cumecs*) to avoid catastrophic drawdown of the lake levels. This is sufficient to generate 180 megawatts (MW) of power at the two plants which, combined with production from thermal units, provides for estimated total power of around 300 MW, which is sufficient to meet off-peak electricity demands. However, already in May 2011, peak demands had reached over 440 MW.

Despite efforts to meet peak demand for electricity, load shedding had to be introduced. In June 2011, the Directorate of Water Resource Management (DWRM) authorized Eskom to increase water discharge for power generation to 1,000 cumecs in order to meet the peak demand for electricity. However, this measure was still insufficient, so load shedding was introduced. At the beginning of September, a request to continue withdrawing 1,000 cumecs was made for at least two months, when the new Bujagali plant was scheduled to become operational.[18] The alternative was to increase load shedding significantly, which would have had very negative impacts on production in the consumer sectors of industry and trade. Temporary permission was apparently granted to avoid increased suffering for the population who was already facing higher costs of living and other difficulties arising at least partly from the rainfall deficit conditions.[19]

The rainfall deficit situation in 2010 and 2011 raised the costs of electricity generation for Uganda.

[18] See *UMEME: We have no choice but to increase load-shedding,* Daily Monitor, 12 September 2011.
[19] See *Uganda allows Eskom to take up more water for hydropower,* The East African, 12 September 2011.

Compared to 2009, the share of hydropower generation decreased by 2 percent in 2010 and by nearly 4 percent in 2011. At the same time, bagasse electricity generation at the Kinyara and Kakira sugar mills declined by 10 percent in 2010 and by a further 40 percent in 2011 due to lack of sugarcane availability. Diesel-fueled thermal power plant generation increased to compensate for the decline in hydropower and bagasse generation, and total costs for energy generation for the entire electrical system rose in proportion to the shift toward thermal generation.

The assessment estimated that total losses of 106.3 billion Shillings were incurred as higher-than-normal costs of electricity generation for the entire system. The assessment found that losses of 54.5 billion Shillings were incurred in 2010, and 51.7 billion Shillings in losses were incurred in 2011. These costs are now responsible for the recent increases in rates to be paid by both residential and industrial consumers, which are generating heated debate among legislators and the public.

In addition to the costs of electricity generation, the load shedding introduced since 2010 has also caused production losses and higher costs of production for the consumers. The effects have been felt especially by those in the manufacturing and trade sectors, who have had to interrupt production activities or resort to utilizing generators for electricity during the temporary brownouts. These losses for the producer sectors have not been estimated—except in the case of the sugar mills, where they amounted to 3.8 billion Shillings—due to insufficient quantitative information, but they should be in the same range as the higher costs sustained by the electrical system.

E. Water Supply[20]

The extended dry period during 2010-2011 led to reduced water supplies, particularly in the dry areas of the cattle corridor. In total, over 35 districts representing about 30 percent of Uganda were reported to be affected. In the affected urban areas, water supply enterprises had to reduce the amounts of drinking water provided to consumers and sustain correspondingly lower revenues. At the same time, they faced higher-than-normal operational costs of running the water systems. In the affected rural areas, shallow wells reportedly dried up completely, and in some cases, the water depths and yields of deep boreholes were reduced. Water users then had to move longer distances in search of water or had to wait longer times to get water from water facilities that had reduced yields, creating more demand on the sources.

Based on an assessment of losses in sampled districts, losses in the water supply sector were estimated at 1.9 billion Shillings. Twelve districts were visited to ascertain the damage and losses to water supply due to the dry spells,[21] and the results were then used to extrapolate losses for the other 27 districts. As shown in Table 28, higher cost of operation was the major source of loss, compared to the revenue lost due to drought.

The assessment found that within affected districts, losses were generally higher in rural areas than in urban areas. This difference is largely attributable to the reliability of

Table 28: Water and sanitation losses due to the 2010-11 rainfall deficits

Source of Loss	Losses, million Shillings		
	2010	2011	Total
Revenue losses	359.8	239.8	599.6
Higher cost of operation	756.1	504.0	1,260.1
Total	**1,115.8**	**743.9**	**1,859.7**

[20] The Consultant's report on water indicates that sanitation was not affected and was therefore not included in the heading of this section, although the sector remains Water and Sanitation.

[21] Nakasongola, Katakwi, Bulambuli, Pallisa, Moroto, Nebbi, Adjumani, Kotido, Lyantonde, Kayunga, Isingiro, and Kiruhura.

piped urban water supplies as compared to the point water sources in rural areas. In fact, the assessment found that most private water operators in the urban areas considered frequent electricity cuts to be the main operation problem, rather than the dry spell itself.

F. Health

Losses in the health sector arise from activities aimed at providing health care to the affected population, which is usually a top priority in any disaster. Losses include even structural expenses such as renting and setting up tents and other improvised health facilities. Emergency personnel costs, treatment of the affected persons, whether physically or psychologically, and the cost of preventing and controlling possible diseases are also added to losses during assessment. Losses could also include the cost of temporary nutritional schemes in case of food insecurity caused by the disaster.

Total losses in the health sector resulting from the rainfall deficit situation were estimated at 14.9 billion Shillings or US$6.3 million. Losses in the health sector were mainly related to higher morbidity costs as well as vector control costs. As shown in Table 29, more losses were experienced in 2011 compared to 2010, and the public sector incurred greater losses than the private sector.

Table 29: Losses in the Health sector due to the 2010-11 rainfall deficit in Uganda

	Losses, million Sh			Ownership	
Source	2010	2011	Total	Public	Private
Higher morbidity costs	1,913.9	6,312.6	8,226.5	4,947.7	3,278.8
Vector control costs	1,661.8	5,006.8	6,668.6	5,583.2	1,085.4
Total	**3,575.7**	**11,319.4**	**14,895.1**	**10,530.9**	**4,364.2**

Analysis of changes in morbidity for different diseases due to the 2010-2011 rainfall deficits underscored the relative significance of malaria. Enormous increases were recorded for malaria morbidity, followed by diarrhea. Other diseases with increased morbidity during 2010 and/or 2011 included eye infection, anemia, and cholera (only in 2011 for the last two). Due to their nature and relationship with drought, some other diseases recorded negative changes. Nonetheless, overall morbidity increased due in large part to the overwhelming numbers recorded for malaria and diarrhea.

G. Education

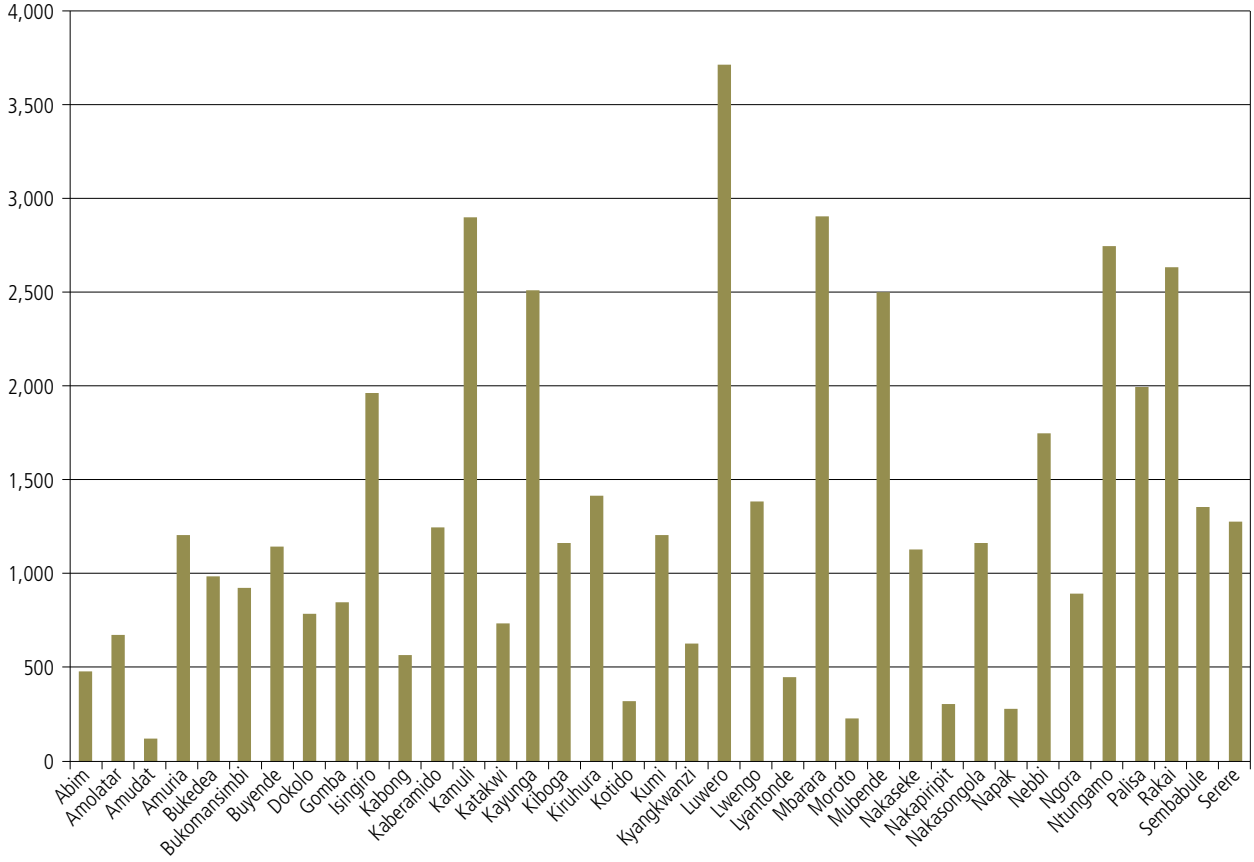
Although the assessment found that classes were not interrupted, the rainfall deficit had other negative effects on the education sector. Some children temporarily dropped out of school to take care of water-fetching activities and because parents could not meet school dues. The rainfall deficits affected the food supply, resulting in higher prices of food to be provided to children as well as a general increase in price levels for all commodities that affected other scholastic materials. The average school fees that families had to pay increased by 11,500 Shillings at the primary level and by 52,050 Shillings at the secondary level per annum.

The assessment used the increase in average school fees to estimate losses in the education sector. Using districts as units, the difference between total expenditures in terms of fees during 2010 and 2011 was taken to represent the amount of losses to families in each district. Because enrollment increased in most districts as a result of government policies, using the differences between expenditures could introduce a significant error in the estimation of losses. Therefore, the change/increase in average rates of school fees was used as the marginal measure of losses. Total district losses equaled the product of the average increase in fees and district enrollment during 2011. The district estimates were then summed to

determine gross/total losses in the sector. The estimates therefore only considered monetary losses due to increased expenditure on schoolchildren, leaving out any indirect losses associated with school dropouts, reduced academic performance, and loss in future incomes and opportunities.

Losses in the education sector totaled 48.6 billion Shillings or US$ 20.4 million. Of these losses, 30.2 billion Shillings or US$ 12.7 million were at the primary level, and about 18.4 billion Shillings or US$ 7.7 million were at the secondary level. Among the sampled districts, Luwero, Mbarara, Kamuli, Ntungamo, Rakai, Kayunga, Mubende, and Isingiro experienced the greatest losses, while the districts of Amudat, Kotido, Moroto, Nakapipirit, Napak, and Kabong were the least affected (Figure 13).

Figure 13: Distribution of losses in the education sector, by district



It should be noted that the results on the spatial distribution of losses can be misleading and should be treated with care. The analysis showed that the most affected districts were in the cattle corridor, while the Karamoja-based districts were the least affected. This reflects the importance and attention given to education as well as population sizes. The most affected districts were higher-income districts, where people value and can afford education. This distribution has important implications for recovery measures, which should address districts with high losses while at the same time approaching the lowest losses in other districts as a problem rather than a positive outcome.

H. Food Assistance

Due to the losses in food production, the GoU spent significant amounts on the provision of food

assistance to those who had lost their crops and faced food insecurity. The total amount spent to help some sections of the affected population deal with food scarcity and avoid possible death due to hunger was estimated to be around 16.9 billion Shillings. Table 30 gives the breakdown in terms of actual assistance and the related transport costs.

Table 30: Losses from food assistance due to the 2010-11 rainfall deficits in Uganda

Item	Losses, million Shs.		
	2010	2011	Total
Food assistance	11,805.5	3,723.4	15,528.9
Transport costs	799.2	582.4	1,381.6
Total	**12,604.7**	**4,305.8**	**16,910.5**

Source: OPM

SECTION IV

Recovery and Reconstruction Needs[22]

[22] Uganda's experience with rainfall deficits has many similarities to the experiences of other developing countries affected by natural disasters.

The GoU fully acknowledges that the 2010-2011 rainfall deficit could be viewed as a trigger for addressing important development issues in the country. Uganda will rise to the challenge of updating recovery and reconstruction programs forming a foundation for the modernization of the affected areas, particularly in the north and northeast (Karamoja sub-region) as well as the cattle corridor districts. The adoption of effective risk reduction measures will also help Uganda avoid or mitigate the negative impacts of future droughts or other natural disasters.

If adequate measures to reduce risk are not put in place and no action is taken following this assessment, similar disaster-related impacts are likely to recur. Since the country depends on rainfed agricultural production, proactive efforts are needed to shelve the backbone of both the economy and livelihoods. Rain-fed agriculture is being stretched by the current population numbers and the growing regional demand for food. Furthermore, given the rate of environmental degradation, population explosion, loss of soil fertility, deforestation, overgrazing, and global warming, the actual capacity of the agricultural sector is now much lower than the demands it is expected to satisfy. Similar situations can also be seen in the agro-industry, commerce, electricity, water and sanitation, and health sectors.

Although post-disaster strategies usually follow the principle of "building back better," it should be noted that this is not enough in the Ugandan context. The effects of water deficits on Uganda are related to the country's state of development and the inherent challenges of limited technology. Disastrous effects of drought are not unexpected for a country that is considered to be well-endowed with water resources but that still relies on rain-fed, subsistence agriculture.[23] Much of the production technology remains effectively traditional yet somewhat rudimentary and haphazard; with limited irrigation and almost no use of fertilizers.[24] Furthermore, the country is experiencing an insufficient skills mix, particularly for the youth, and a lack of capital, adequate planning, and modern management of public affairs. Reducing the impacts of future droughts requires attention to important aspects of governance such as land use planning, water management, environmental protection, and disaster risk reduction. Although the actual water balance analysis has not been done, Uganda's geographical location near the dry Horn of Africa predisposes it to possible rainfall deficits.

Recovery efforts should place special emphasis on assisting the poor and vulnerable, who are the most affected by such disasters. The poor and vulnerable rely on the land for subsistence and do not have alternative sources of livelihood or income for survival. Furthermore, the marginal impact of loss or damage is greatest among low-income earners, so a drought is likely to push those living just above the poverty line back into poverty. Their ability to recover is hampered by limited access to credit, inadequate support services such as extension services, insufficient short-term support from public assistance programs, and few medium- to long-term opportunities for recovery. They need an injection of capital and access to supporting employment opportunities. In particular, improved farming facilities that allow people to resume their traditional livelihoods will provide the best opportunity for sustainable recovery for the poor.

This section presents estimates for recovery and reconstruction as well as suggests strategic directions for helping Uganda manage such disasters in the future. It summarizes the recovery and reconstruction needs by sector as well as explains how the needs were estimated. Some of the key measures needed in each sector to help ensure the recovery of economic activities and rebuild destroyed assets are described. Priority areas for disaster management and disaster risk management are also proposed. In addition, the section discusses financing for the recovery and reconstruction program.

[23] Uganda is considered to be well-endowed with water resources as 15 percent (36,902 km^2) of its surface is covered with water, while an additional 3 percent (7,325 km^2) is covered with permanent and seasonal swamps (MWE, 2010a).

[24] Only 9,000 out of 5.6 million hectares of Uganda's land area are under irrigation.

A. Recovery and Reconstruction Program

Based on the assessment of damage and losses, financial needs for recovery and reconstruction following the 2010-2011 drought were estimated for each sector. The two main objectives are: (i) recovery of all economic activities at the macroeconomic, sectoral, and personal/household levels and (ii) reconstruction of damaged or destroyed assets (in this case, the livestock that died due to the drought). Financial needs for reconstruction were based on the estimated value of damage while adopting a strategy that seeks to introduce disaster-resilient standards, depending on funding availability. A "build back better" strategy requires a range of activities in areas such as quality and technological improvement; adoption of improved farming practices like high-yield drought-resistant varieties, introduction of irrigation, and use of fertilizers; and better and quick-maturing crops and animal husbandry.

A total of 423.8 billion Shillings or US$173 million[25] is required to achieve recovery and reconstruction following the 2010-2011 rainfall deficits in Uganda (Table 31). Of that amount, 123.8 billion Shillings (29.2 percent of the total needs) represents the financial requirements for reconstruction, or the replacement of the animal stock that died due to the drought. The balance of 300 billion Shillings (or 70.8 percent of the total needs) represents financing required to achieve recovery of production and social conditions.

Table 31: Recovery and reconstruction needs after 2010-2011 rainfall deficits in Uganda

		Needs, million Shillings		
Type of need	Sector	2012	2013	Total
Recovery		**208,319**	**91,735**	**300,054**
	Crops	98,013	39,205	137,218
	Livestock	37,583	19,250	56,832
	Agro-industry	55,198	22,079	77,277
	Water supply	800	320	1,120
	Health	8,270	4,962	13,232
	Food Assistance	8,455	5,919	14,374
Reconstruction		**79,116**	**44,702**	**123,818**
	Livestock	79,116	44,702	123,818
Total		**287,435**	**136,437**	**423,872**

Source: Estimations by Assessment Team based on damage and losses.

Recovery and reconstruction program funds are to be channeled via two main sources: cash or in-kind grants focused on the poorer strata of the population and credit lines under special, soft terms for creditworthy individuals and enterprises. The first type of activity is to be managed directly by the GoU through its different sectoral Ministries and units, with assistance from non-governmental organizations (NGOs) whenever they may provide significant economies in its implementation. The second type of activity is to be channeled through the private banking sector and/or the development bank, as special post-drought credit under soft conditions of interest and repayment periods. While the government would not execute or finance the second set of recovery and reconstruction activities, it will play a special promotional role with the private banks to ensure the establishment of such credit lines.

[25] Using an exchange rate of 2,450 shillings per one US dollar exchange rate.

The envisaged recovery and reconstruction activities are to be undertaken in 2012, 2013, and 2014, with a concentration of activities in the first year and an appropriate phasing out in 2014. Needless to say, this assumes that the dry spell would have ended by end-2011. Details on the recovery and reconstruction activities by sector are summarized below.

Agriculture

The post-drought recovery and reconstruction needs for agriculture are estimated to be 317,868 million Shillings (Table 32). According to the assessment, the total needs for all the economic sectors are estimated to be 423,872 million Shillings, with agriculture accounting for almost 75 percent of this amount. The breakdown of total needs for agriculture can be summarized as follows: (i) approximately 61 percent of the total refers to recovery needs, and the remaining 39 percent refers to reconstruction ("build back better") needs; (ii) out of the total needs, 43 percent is for recovery for crops and 57 percent for recovery and reconstruction of livestock; and (iii) in terms of time, 68 percent of the total is for 2012 and the remaining 32 percent is for 2013.

Table 32: Estimated recovery and reconstruction needs for agriculture in Uganda

		Needs (million shillings)		
Type of need	Sub-sector	2012	2013	Total
Recovery	Crops	98,103	39,205	137,218
	Livestock	37,583	19,250	56,832
Sub-total - Recovery		**135,596**	**58,455**	**194,050**
Reconstruction	Livestock	79,116	44,702	123,818
Total Agriculture		**214,712**	**103,157**	**317,868**
Total Uganda All Sectors		**287,432**	**136,437**	**423,872**
% Agriculture of Total Uganda		**75**	**76**	**75**

Source: Assessment Team estimates.

The recovery needs for crops consist of seeds, seedlings, manure, fertilizer, use of equipment, pesticides, and both family and hired labor. Similarly, the recovery needs for livestock consist of feed, fodder, veterinary care, medicine, drinking water, and both family and hired labor. The reconstruction needs for livestock consist of purchase of young livestock (healthy and improved breed) and the inputs needed for raising this young livestock until they start producing milk or meat. In addition to smallholders' own savings (which are very little), these recovery and reconstruction needs can be met through (i) cash and in-kind grants from the government agencies and (ii) new credit on soft terms and/or writing off old debt and/or rescheduling existing debt. In this context, both the government and the private sector are involved in meeting the recovery and reconstruction needs. Time is of the essence, since promoting rapid recovery requires that all the recovery and reconstruction programs be put in place very quickly.

The livestock subsector is the only one that has needs for reconstruction which, in this special case of a drought, refers to the cost of restoring the stock of domestic animals that died due to the rainfall deficits. While it is possible to approach this recovery through a natural process by allowing sufficient time to elapse and have the animal stock recover in about three years' time, cattle owners urgently need financial assistance to purchase animals to restock and to be able to begin obtaining livestock products at the earliest possible time. The needs therefore should include a combination of several measures, including cash transfers to poor cattle growers in the most affected regions of Karamoja and the cattle corridor, as well as credit under special terms, low interest and long repayment period, for the acquisition of cattle.

While it is recognized that there are currently some credit lines open to interested parties, conditions of such credit must be improved to enable cattle keepers to overcome the impact of the drought. In other cases, cattle keepers have already resorted to other informal sources of financing under very strict conditions that are placing impossible financial burdens on them. Cattle keepers also face urgent recovery needs that include government assistance through veterinarian attention for animals that contracted disease due to the rainfall deficit, as well as working capital to restart production of milk and meat and other by-products during the time required (2012 and 2013) to restore their animal stock. Again, these funds must be channeled as cash grants for poor pastoralists and as soft-term credit for creditworthy cattle growers in other affected areas, under better conditions than under the presently available credit lines.

Farmers in the crops subsector face different urgent needs for their recovery that require a combination of cash grants or in-kind donation of inputs as well as financing of working capital or rescheduling of loans. These needs include seeds, fertilizer, and pesticides to restart production of food crops by poor farmers in the most affected regions. Credit is also needed under soft conditions appropriate after the drought for farmers who produce food and cash crops and who are creditworthy. Many farmers have failed to continue paying existing loans since the start of the drought and cannot obtain sufficient working capital and inputs to restart production. Within this context, special attention should be paid to the provision or universal availability of drought-resistant seeds for the farmers.

1. **A range of recovery activities is needed to help maintain food security and mitigate drought effects in the agriculture sector. Measures that have been suggested include:**

a) ***Price stabilization and food subsidies***. Through relief and food aid, the supply of food may be improved, resulting in reduced prices. In addition, the government should identify vulnerable groups and administer some cash income policies to help improve their access to food.

b) ***Employment creation programs.*** These programs can help the affected by increasing their disposable income so they can afford to purchase basic foodstuffs for survival. By engaging people more productively, employment can also increase productivity and output, thereby helping to mitigate the drought effects.

c) ***General food distribution.*** Given the large impacts of the drought on food production and on the capacity of the population to access food, the government needs to implement a food distribution policy, particularly since the drought did not affect all parts of the country equally.

d) ***Supplementary feeding programs.*** The lack of food due to the drought resulted in a reduction in both the quantity and quality of feeding. Supplementary feeding programs should be introduced to ensure minimum nutritional standards, particularly among the poor and young children, 38 percent of whom are currently stunted. School feeding programs should be encouraged.

e) ***Special programs for livestock and pastoralists.*** Efforts must be made to organize the livestock sector, especially in terms of providing pastoralists with reliable sources of water. Pastures and livestock resilience should be improved through the introduction of drought-resistant pasture varieties.

f) ***Complementary water and health programs.*** Extending piped water may greatly support urban agriculture as well as adjacent rural areas. Programs to improve access to piped water, for example Gravity Water Schemes, could be strengthened to at least complement rain as the source of safe drinking water.

g) ***Rehabilitation.*** In the short term, the affected gardens and farms need to be rehabilitated, and an adequate supply of inputs and stocks must be ensured to restore the pre-drought situation. For the long run, however, the "build back better" principle should be applied to help improve resilience to any future disasters.

Agro-Industry

The agro-industry sector has sustained significant losses due to the rainfall deficits and would require re-financing of past loans that may have fallen into default, or are on the verge of default, under special soft conditions. Within the agro-industry sector, the highest recovery needs are in sugar processing. As shown in Table 33, sugar processing needs (34.2 billion Shillings) are followed by coffee (27.2 billion Shillings) and tobacco (6.3 billion Shillings). Grain processing (6.1 billion Shillings) and tea (3.6 billion Shillings) have lower needs.

Table 33: Estimated recovery needs in agro-industry

	Recovery needs (million Shillings)		
Industry	**2012**	**2013**	**Total**
Sugar	24,411	9,764	34,176
Coffee	19,400	7,760	27,160
Tea	2,544	1,018	3,561
Tobacco	4,478	1,791	6,269
Grain milling	4,365	1,746	6,112
Total sector	**55,198**	**22,079**	**77,277**

Source: Assessment Team estimates.

Recovery activities that lead to increased inputs and hence reduced costs will help restore this sector. Revival of rural production with improved seeds supported by use of fertilizers and an efficient irrigation system will help improve production and productivity, helping to promote recovery of the sector. Other interventions that could help restore the agro-processing sector include cash grants for micro-enterprise recapitalization and recovery of production, special soft-term credit lines for SME recapitalization and production recovery, and extension of temporary tax relief schemes.

Water supply and Sanitation

Needs in the water and sanitation sector were estimated at 1.1 billion Shillings. The drinking water supply enterprises in urban areas require recovery assistance that may involve a temporary subsidy from the government to compensate for the revenues not received from consumers during the drought period, as well as temporary financing of water distribution using tanker trucks and other means until water sources recover naturally through rainfall.

An important priority for the water and sanitation sector is to strengthen rainwater harvesting in rural areas at both the household and community levels. Losses in the sector were mainly due to unreliability of piped water in urban areas as well as drying up of point water sources in rural areas. Although sanitation was seemingly not very affected, absence of water in a system never leaves sanitation in normal order. A project to supply water tanks to

Table 34: Estimated needs in the water and sanitation sector (million Shillings)

	Needs, million Shillings		
Recovery needs	**2012**	**2013**	**Total**
Total	**800**	**320**	**1,120**
Subsidy to enterprises (temporary)	300	120	420
Water distribution costs	500	200	700

Source: Assessment Team estimates.

all households with iron-roofed houses and to public buildings like schools, hospitals, churches, and mosques would help address household demands. Community-level water harvesting, which is vital for pastoral communities, would involve construction of valley dams and valley tanks in almost all villages with viable sites. At subsidized costs, most livestock farmers could be encouraged to have at least a valley tank on their farm/land.

Efforts are also needed to expand and improve the distribution of water to the population**.** Measures include construction of extension trenches and channels that can distribute water from available water bodies to points closer to the population. Water lost through evaporation and the system would be replaced during the rainy seasons. Immediate needs include a temporary scheme for drinking water purification, since most rural people in the dry areas rely on stagnant water for all purposes, including drinking. A system for temporary distribution of drinking water through tanker trucks and other means also needs to be established. In addition, construction of latrines would help improve sanitation. An Eco-San Toilet Project, once subsidized, could be helpful in this regard.

Health

Recovery needs in the health sector are estimated at 13.2 billion Shillings. The cost of recovery needs is estimated as the value of the losses minus any amounts already spent at the time of the assessment but not covered by the regular budget of the government. Recovery needs in this sector require a temporary increase in budget allocations from the government in order to fully control the increase in morbidity rates of different diseases caused by the drought, conduct several prevention and information campaigns and activities, and control vectors such as mosquitoes. The estimates are shown in Table 35.

Table 35: Estimated needs in the health sector

	Needs, million Shillings		
Area of intervention	**2012**	**2013**	**Total**
Morbidity control	4,113	2,468	6,581
Vector control	3,334	2,001	5,335
Other prevention activities	823	494	1,316
Total sector	**8,270**	**4,962**	**13,232**

Source: DaLA

Higher morbidity costs and vector control costs accounted for the losses in the health sector, which gives direction to recovery needs in the sector. While it is important to address health problems such as eye infection, diarrhea, and cholera that also resulted in drought-related losses, malaria clearly accounted for the largest share of losses. Home-based care of malaria, coupled with increased and improved care in the general health system and facilities, would be helpful in managing the disease. Indoor residual spraying and greater distribution and use of insecticide-treated mosquito nets would also improve resilience to malaria-spreading mosquitoes.

Addressing malnutrition is another important area for the recovery program. Malnutrition remains a concern for Uganda's health conditions and outcomes and for contributing to losses in the health sector. Measures aimed at ensuring food security, ranging from sustainable production to post-harvest handling and planned marketing, are needed. Efforts to build resilience in the agricultural sector—for example, through irrigation, use of fertilizers, use of improved plant and animal varieties and breeds, and improved farming methods—are critical in this regard in the medium term. Such efforts would not only help address the malnutrition problem but would also contribute to income stability for households.

Food and nutrition

An estimated 14.4 billion Shillings in food assistance is needed to bring the food situation back to normal. It is recommended that such assistance should be supplemented by United Nations (UN) efforts in order to meet adequate food and nutritional requirements of the population. Temporary food and nutrition assistance would be required for selected population groups until food production recovers to normal levels and until malnutrition levels are brought into check. A combination of special budget allocations from the government and international food assistance is required. The assistance should be split into 8,455 million and 5,919 million Shillings for years 2012 and 2013, respectively, to phase out the need, assuming that the rainfall deficit has ended.

B. Disaster Risk Reduction and Management

Given the country's vulnerability to drought, Uganda needs to strengthen both DRR (disaster risk reduction) and Disaster DRM (disaster risk management). As mentioned previously, several factors make Uganda vulnerable to drought. However, the available legal and institutional framework for DRM is mostly oriented toward emergency response and less toward risk reduction. The country's exposure to climate change risks and the occurrence of the 2010/2011 rainfall deficits have underscored the importance of strengthening DDR. The 2010/2011 rainfall deficits also revealed gaps in the DRM framework, highlighting the need to accelerate mainstreaming of DRM into policies and programs at the local and national levels and across different sectors.

To address its vulnerability to drought and similar disasters, developing a more effective disaster risk reduction and management framework is essential. Additional protection will require institutional reform, comprehensive planning, and investment in restoration and new infrastructure. Developing a policy that leads to an acceptable level of risk and protection is critical, as this will determine the economic feasibility of subsequent agricultural and financing choices.

In the medium term, traditional practices of drought management (including food relief, replanting, and restocking) are important; to be accompanied by funding for irrigation and provision of drought-resistant varieties and breeds. Real-time monitoring and early warning systems would be needed to guard against future drought-related disasters. A new institutional structure, building on the existing disaster management structures responsible for managing drought in the whole country, should specifically address drought-prone areas. Disaster management, coordinated by the Office of the Prime Minister (OPM), should be more facilitated and proactive in this regard.

A comprehensive disaster risk assessment to update existing information is also essential, especially on drought. This assessment would feed into the national planning process with the related policies and programs which should emphasize adequate investment in the irrigation system. This would be expected to culminate in a national system for irrigation, as proposed in the National Development Plan 2011-15 and the 2011/12 National Budget.

The existing disaster risk management (DRM) system should become more proactive, coherent, and effective. Improving scientific data for predicting and forecasting disasters is therefore paramount. The mainstreaming of DRM into the planning process is critical for reducing disaster risk to acceptable levels. This calls for adequate disaster risk financing that emphasizes risk transfer rather than risk retention.

C. Financing

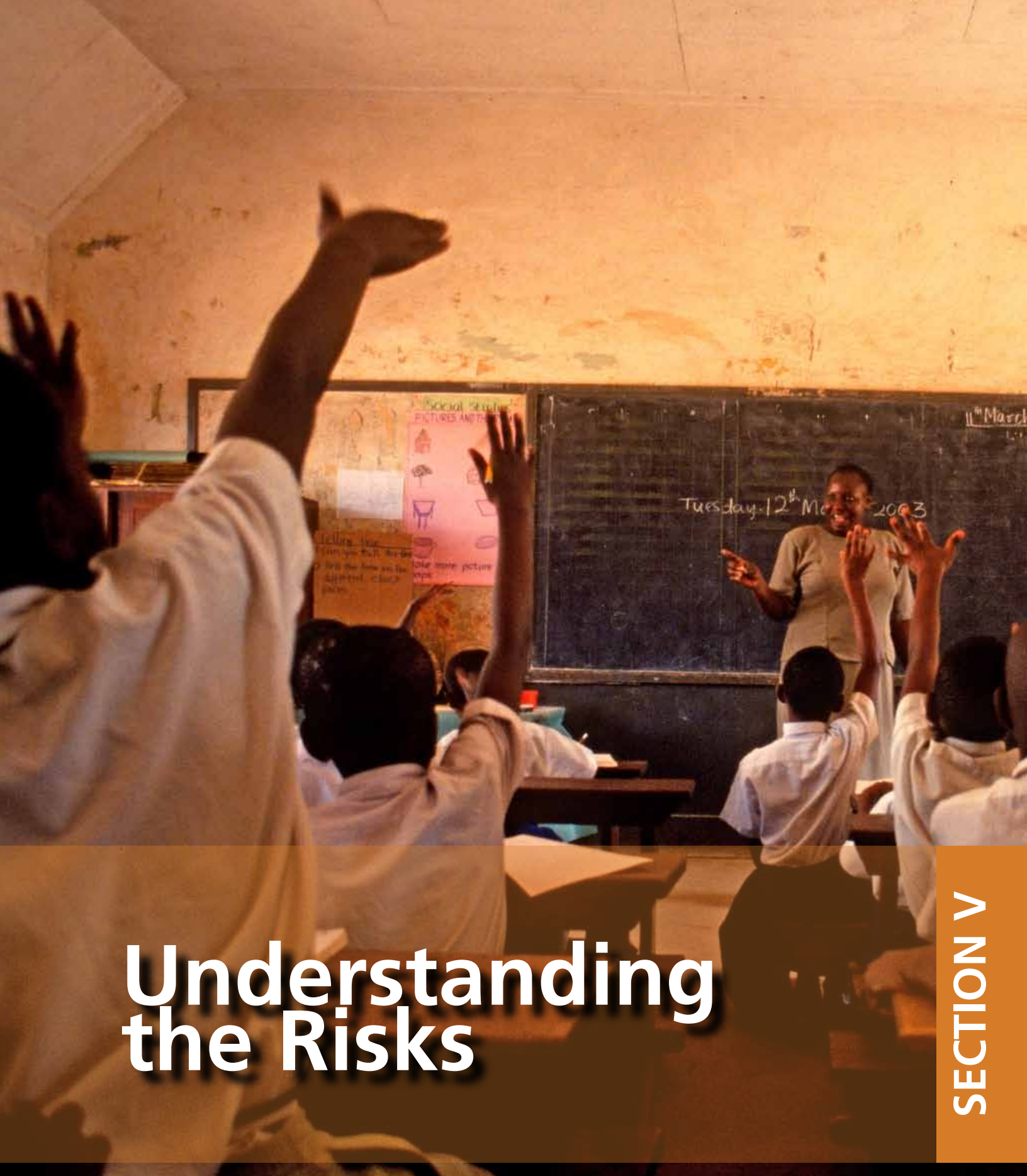
Recovering from rainfall deficit is costly, but the costs of not implementing the necessary activities would be even higher. The total needs for recovery and reconstruction have been estimated at 423.9 billion Shillings or US$173 million. As discussed above, Uganda has the opportunity to not only "build back better" but also to implement changes that will help the country be better prepared for future disasters. Uganda currently has limited capacity in disaster management, so the problems of the 2010-2011 rainfall

deficits are likely to re-occur unless urgent efforts are made to mitigate the effects of future disasters.

Funding for recovery and reconstruction as well as disaster management in general can come from a number of sources. Suggested sources include:

a) Government budget;
b) Financial support from international development partners;
c) Borrowing from multilateral and bilateral sources, including on accelerated emergency terms;
d) Reallocation of funds under ongoing donor-supported projects and programs;
e) Local governments that have the accumulated resources to support recovery and reconstruction in their communities;
f) The private sector, through use of savings, insurance proceeds when available, and commercial credit;
g) "Sweat equity" through community contributions at the local level, particularly in providing the required labor and implementing the recommended disaster risk reduction operations, especially on the land.

The strategy for DRM financing must strike a balance between public and private sources of risk financing. Contingency (or site-specific) financing is most appropriate for managing moderate drought risks. National budgets must make adequate provisions for cases of disaster, and local governments should be empowered with more resources to address urgent needs. At the same time, the role of the private sector should be increased, since disaster affects a wide spectrum of stakeholders from the international level down to the individual level.



Understanding the Risks

SECTION V

A. Brief History of Natural Disasters in Uganda

Over the past decade, Uganda has frequently been inflicted by disasters of different forms, both natural as well as human-induced. According to the Uganda National Household Survey of 2005/06, approximately 65.7 percent of total households in the country experienced at least one type of disaster over the period 2000 to 2005. In particular, the Northern Region registered the highest prevalence of disasters at 88.7 percent, while the Central Region recorded the lowest rate of 53.3 percent. The Eastern and Western Regions posted fairly similar proportions of households affected by disasters, estimated at 63.6 percent and 65.4 percent, respectively.

In addition to droughts, some common disasters that affect different parts of the country include:

a) **Floods**, which are among the most devastating natural hazards in parts of the low-lying areas of Uganda. In recent times, the phenomenon of flooding has been aggravated by land degradation caused by deforestation of catchment areas, poor land-use planning, and management of wetlands. In 2007, parts of Northern and North Eastern Uganda experienced devastating floods. The flooding affected an already highly vulnerable area of Uganda, where the majority of households depend on subsistence agriculture and where basic services are already severely overstretched as a result of insurgency and cattle rustling.

b) **Landslides**, which have been devastating in the hilly and mountainous areas of the Elgon Region, southwest, and the sub-region of Rwenzori. On March 1, 2010, landslides in Bududa District resulted in roughly 350 lives lost, in addition to losses in infrastructure, crops, livestock, and so on. Although heavy downpours may cause landslides, acts of de-foresting steep slopes and poor land use management caused by overpopulation are also contributing to the occurrence of landslides.

c) **Earthquakes**, which though occasional, also affect people and their livelihoods. Parts of Western Uganda that are part of the East African Rift Valley System have geological rifts that are tectonically unstable and therefore occasionally prone to devastating earthquakes. The Rwenzori sub-region experienced devastating earthquakes in 1964 and in 1994. The 1994 earthquake affected thousands of people, destroyed homes, and disrupted daily activities.

As noted previously and despite strong economic growth in recent years, Uganda continues to suffer from inherent high vulnerability to climatic shocks, particularly recurrent droughts. As this assessment has shown, droughts[26] have profound impacts on the economic and social well-being of already vulnerable people and pose a major threat to the sustainable development of a country. Droughts particularly affect the most vulnerable population due to the impacts on water availability and livestock or agricultural production, and thus also have profound negative implications for poverty eradication efforts. This chapter focuses on understanding drought risk or the factors that contribute to drought in Uganda to help inform the development of a strategy and action plan to mitigate the impacts of future droughts. The discussion also highlights best practice examples from other countries to help avoid reinventing the wheel and to enable Uganda to embark on drought/disaster resilience efforts without much delay. The chapter concludes with a discussion of how current and future World Bank projects can be used to promote recovery and build resilience from drought in Uganda.

B. Droughts and Drought Risk in Uganda in Detail

With the exception of small areas under irrigation (about 15,000 ha, mainly for rice), all of the crops and pastures are rain-fed in Uganda. Rains are not very reliable due to delays in the onset of rains, not enough rains, or inadequate rains at the right

[26] High rainfall variability in this case.

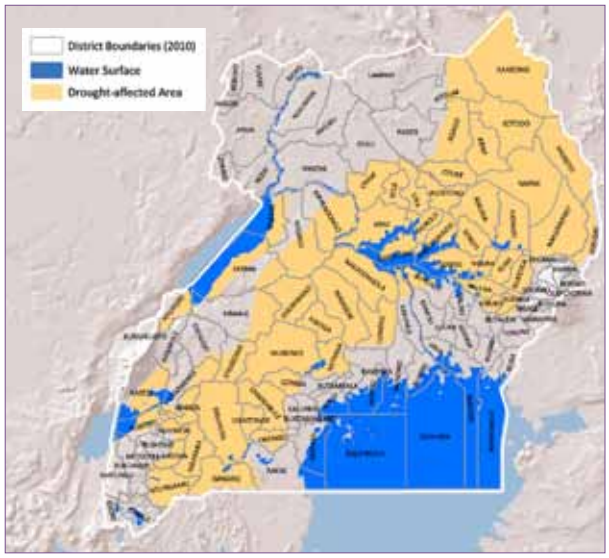
time and place for agriculture during the crop cycle. Uganda has suffered from periodic droughts in the past with serious effects on the vulnerable population, as indicated in Table 36 which shows the number of people affected in the most recent major droughts. In Uganda, droughts have been recurrent in the cattle corridor districts (shown in brown in Figure 14) of Gulu, Apac, Lira, Moroto, Kotido, Soroti, Kumi, Mbarara, and Ntungamo. Compared to earlier droughts, the 2010-11 drought was moderate and localized, mainly in the cattle corridor and the Karamoja sub-region.

Approximately 600,000 people were affected in drought year 2005, most of them in the Karamoja sub-region. However, the 2003-06 drought caused much more impact with water level drops in various lakes (including Lake Victoria and Kyoga), reduction in water flows, hydropower generation shortfalls, widespread famine, and livestock deaths reported during that period.

Table 36 and Figure 14: Recent droughts in Uganda and drought affected areas

Drought Year	Affected Population (in '000)
1998	126
1999	700
2002	655
2005	600

Source: Disaster Risk Reduction Thematic Paper, Office of the Prime Minister, March 2009.



With climate change, rainfall variability and temperature rises are likely to increase, so drought frequency and intensity may also increase. The frequency of drought is already increasing. In the 30-year period from 1970 to 2000, there were twice as many droughts in Uganda as there were in the 50-year period from 1920 to 1970. According to the Government of Uganda, about half of the country's districts are likely to become drought-prone by 2035. Thus, a clear drought risk management strategy is greatly needed in the country.

Impact on food insecurity

According to the Ugandan National Household Survey for 2005/06, a person is considered food insecure if food intake is less than 2200 kcal/person/day. The latest information, available only for 2005/06, indicates that the national average for food intake was 2190 kcal/person/day. The share of the Ugandan population below the food insecure kcal levels was 60 percent in rural areas, 73 percent in urban areas, and 62 percent nationally.

In the Karamajo, Acholi, and Lango sub-regions, over 85 percent of the population was considered food insecure. The average food intake was 1455, 1409, and 1606 kcal/person/day in Karamoja, Acholi and Lango, respectively. These are also the areas that have a large number of pastoralists and livestock in Uganda. Historically, these areas have faced acute and chronic food insecurity due to conflict, insecurity, and frequent

droughts. The World Food Programme (WFP) has indicated that they have been implementing school feeding programs (SFP) as well as food for work (FFW) or cash for work (CFW) programs in these regions on a large scale and for many years in order to address the problem of food insecurity. Given that the main cause of household food insecurity is drought, it will be very difficult to improve food security unless the Government of Uganda is able to implement a drought risk management (DRM) strategy and sustain it over time.

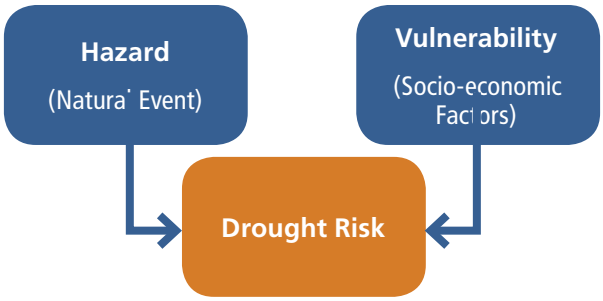
Understanding drought risk in Uganda

Disaster risk can be understood as a product of hazard or a potentially damaging physical event and the vulnerability or susceptibility of population and assets to suffer loss. It is the result of a region's exposure to the event (i.e. probability of occurrence at various severity levels) and the vulnerability of society to the event. While disasters are considered to be external shocks that destroy development gains, disaster risk is internal to the development process, as illustrated by Figure 15. The concept of drought risk presents ex-ante or preventive thinking, including a holistic understanding of why disasters occur, their impact on development, and how they can be prevented.

Hazard factors - High rainfall variability and evapotranspiration rates

Rainfall occurs in a generally long rainy season extending from about March to November (averaging about 1200 millimeters per year), but potential evapotranspiration rates are very high. The distribution of average annual rainfall across Uganda varies significantly, as shown in Figure 16. Groundwater recharge and sustainable groundwater yields show similar patterns of spatial variability. About one half of all districts in Uganda experience annual rainfall deficits—the difference between evapotranspiration and rainfall—ranging from slightly above zero to 400 mm. The dotted grid cells in the figure below indicate areas with a rainfall deficit, which could lead to depressed crop yields for rain-fed farmers particularly where soil moisture storage is limited naturally or where poor soil management has degraded soil quality, which is a major problem in many parts of Uganda.

Figure 15: Factors contributing to drought risk



Climate variability and climate change

Uganda receives lower than expected rainfall most of the time, thus droughts are frequent and pervasive. Figure 17 shows that the frequency of rainfall anomalies below normal (or long-term average) is significantly greater than the frequency of rainfall above normal.

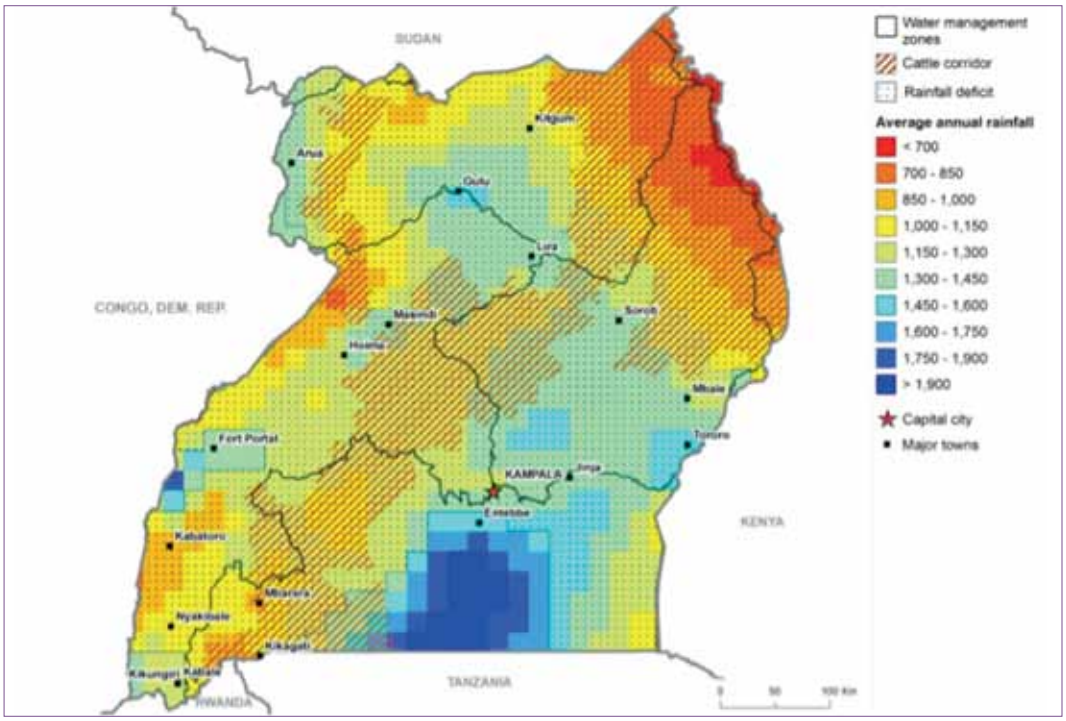
Climate change is likely to increase temperature and rainfall variability further, leading to higher incidences of droughts and water scarcity in the country. Climate scientists predict a warming trend in Uganda, along with likely higher precipitation during rainy seasons.[27] This could lead to water scarcity issues in the summer. Uganda may therefore face dual challenges related to both flood management and droughts in the future.

Vulnerability factors

While not much can be done about a region's exposure to a natural event since it results from large-scale disruptions in the global circulation pattern of the atmosphere, vulnerability can be addressed with preparedness, resilience, and response planning. Vulnerability is a function of socioeconomic factors. In Uganda, vulnerability to droughts results from limited institutional capacity to manage disasters and from

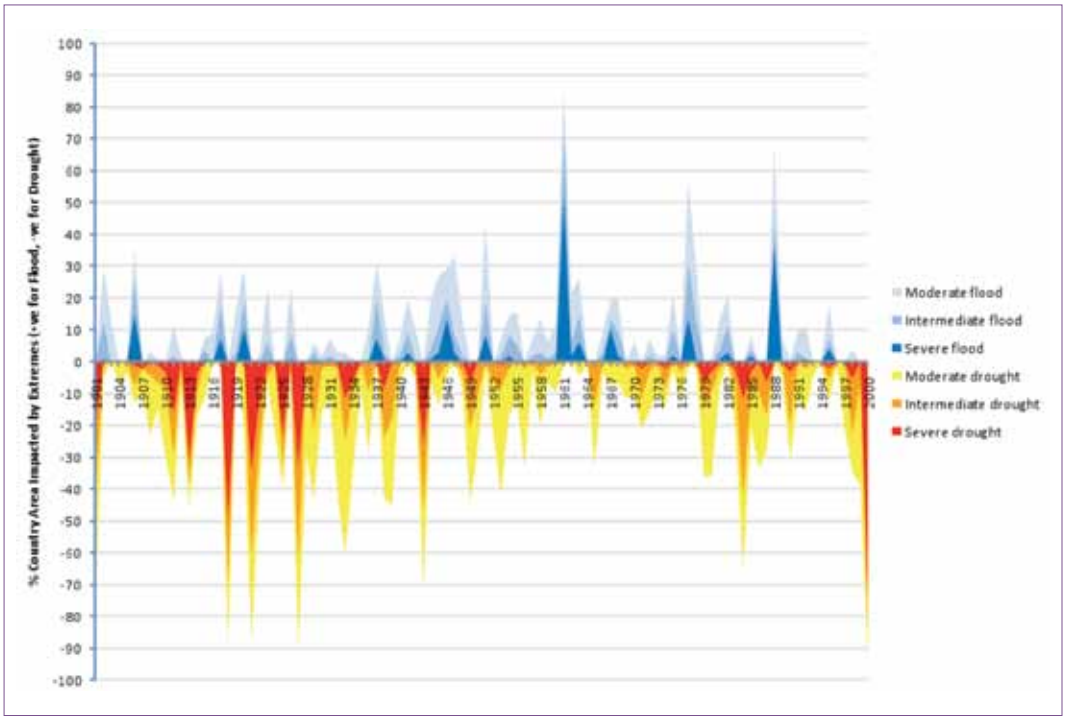
[27] Westphal, Michael (2010). Uganda and the Lake Victoria Basin: Historic Climate and Future Climate Change.

Figure 16: Distribution of average annual rainfall across Uganda



Source: MWE, 2011

Figure 17: Historic climate variability in Uganda, as captured in the WASP



Source: Brown et al, 2008.

the relatively lower coping capacity of pastoral and agro-pastoral communities that are exposed to cyclical droughts. Some of the key underlying vulnerability factors are discussed below.

Limited institutional capacity to manage disasters contributes to the country's vulnerability. Although the GoU has taken many steps to move from a "reactive approach" of responding to disasters to a more preventive approach of disaster risk management, it faces several challenges in ensuring disaster preparedness and mainstreaming disaster risk management across development sectors. The Government has established a dedicated department of Disaster Management and Refugees in the Office of the Prime Minister, which provides multi-sectoral coordination and coordination in disaster risk management. The Government of Uganda's Disaster Risk Reduction Five Year Strategic Plan (2010 to 2016) identifies drought as the most severe disaster affecting lives and livelihoods of citizens. However, there is no clear policy on management of drought risk and drought contingency plans. Drought early warning is either not available in the country or is mainly directed at response actions.[28] Major constraints to drought policy and plan development include: sub-standard quality of meteorological networks, minimal understanding of drought impacts, lack of coordination and institutional capacity, low level of NGO involvement in drought management, lack of understanding on household vulnerability, and inadequate financial resources for drought management and human resources development.

The reliance on rain-fed agriculture also contributes to vulnerability. Agriculture's share in the economy has decreased significantly over time, but the sector is still a key driver of economic growth and is critical for poverty reduction and food security. The sector's growth rate has remained low since 2003, barely reaching a high of 2 percent in 2008. Declining agricultural productivity is a primary concern. Reasons include declining soil fertility, an almost complete reliance on rainfall and inability to compensate for seasonal and monthly variability, land tenure insecurity, and poor market access. Extreme climatic variability combined with the low productivity of predominately rain-fed farming in Uganda means that food security in the country remains a serious concern.

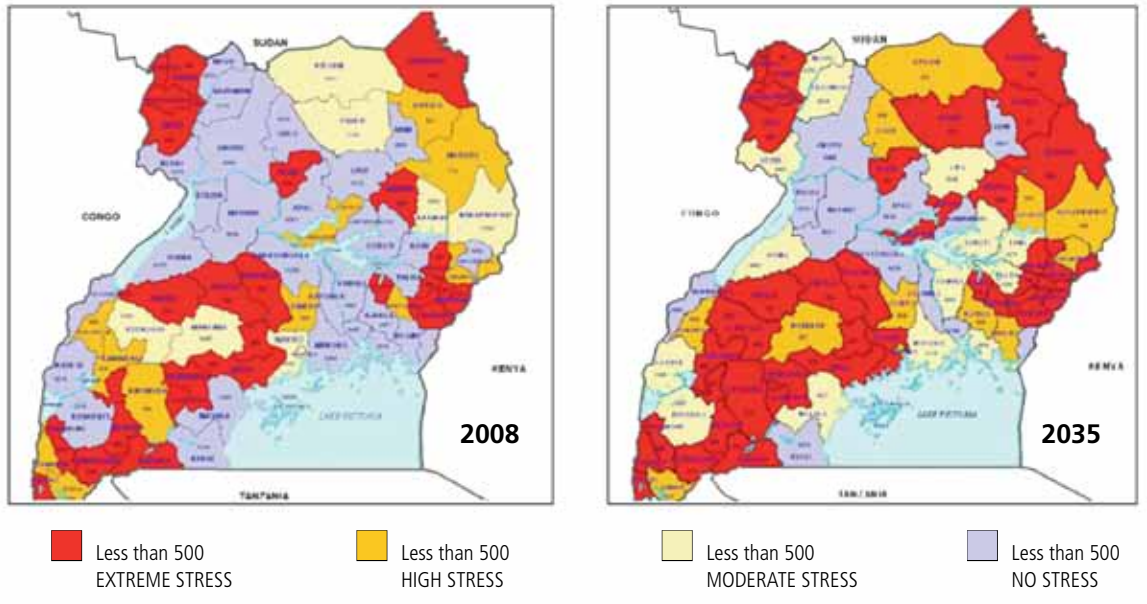
The vulnerability to droughts is exacerbated by population growth and water stress. Uganda has the third highest fertility rate and one of the youngest populations in the world. At an estimated 30.7 million, the population has doubled in the last 20 years, and it is projected to nearly double again by 2030 to reach 60.8 million. The Government estimates that almost three-fourths of districts will experience high (water availability between 500 and 1000 m^3/person) or extreme (less than 500 m^3/person) water stress (Figure 18). Although the estimates can be questioned, they highlight the general mismatch between water resources availability and water use in the country.

Limited access to basic services and infrastructure is another contributing factor to vulnerability. Transport connectivity is a rising concern, as it is key to improved market access and mobility of labor. A particular challenge is the secondary and tertiary network, particularly rural roads, which are in extremely poor condition where they exist at all. Opportunities for developing hydropower as well as other renewables are being taken up at a slow but steady pace, and access to electricity is a particular problem in rural areas. Poor and unreliable electricity carries a huge cost to industry and limits the range of technologies available to the rural and agricultural sectors (especially small-scale irrigation, water supply, and agro-processing technologies). Access to education, health, and other community services are also limited for at-risk pastoral and agro-pastoral populations, thus exacerbating vulnerability.

Environmental degradation and natural resource depletion also increase the country's vulnerability to droughts. An estimated 90 percent of Uganda's population relies on natural resources and the environment for their livelihoods. However, rampant environmental degradation and depletion of natural resources

[28] Wilhite (2000). "Drought Preparedness and Response in the Context of Sub-Saharan Africa." *Journal of Contingencies and Crisis Management,* Volume 8, Number 2, 2000.

Figure 18: The distribution of water stress in Uganda



Source: MWE SIP, 2008.

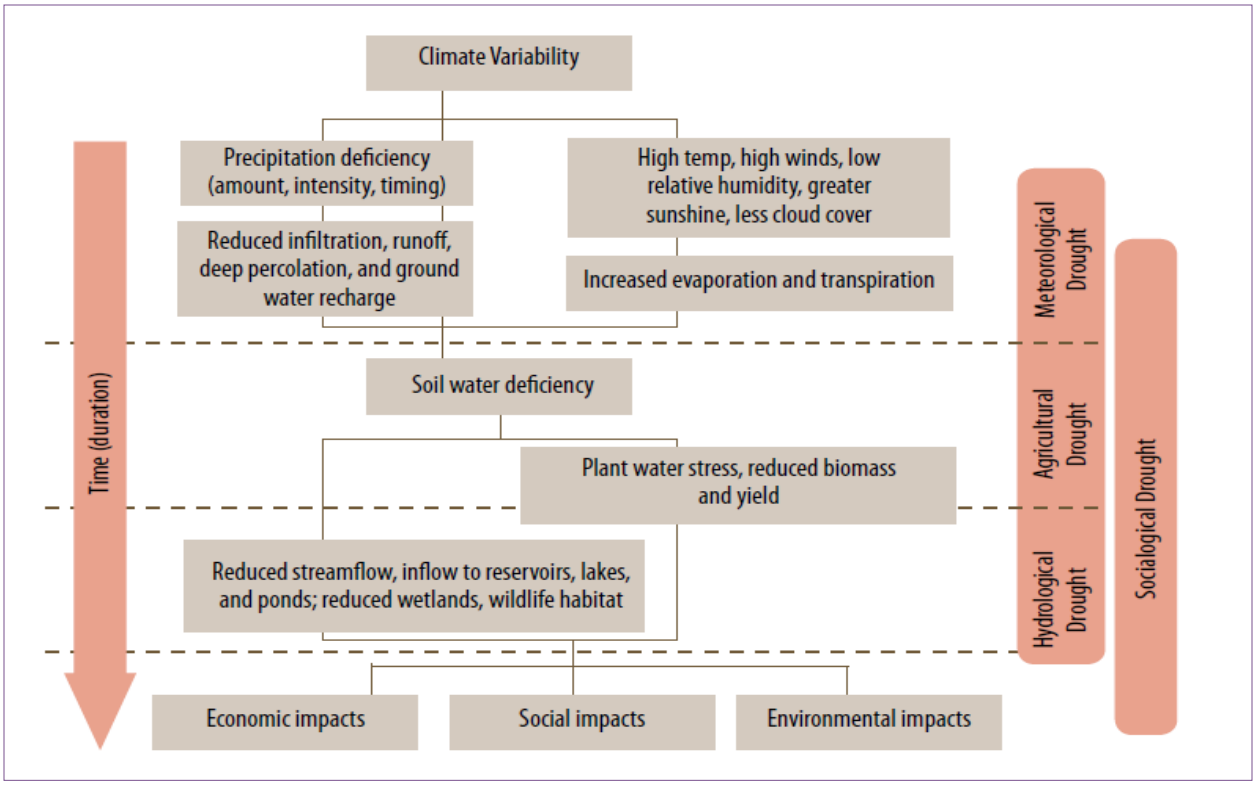
could jeopardize Uganda's growth prospects. It is estimated that 27 percent of Uganda's forest cover was lost between 1990 and 2005, and at current rates, woodlands will disappear within 30 years. Meanwhile, 73 percent of Ugandans use firewood for cooking.[29] Wetlands are also being destroyed at an alarming rate, particularly due to conversion near urban areas and for agriculture in seasonal wetlands. According to some estimates, wetland area decreased by as much as 17 percent by 2005.[30] Both surface and groundwater quality are deteriorating. Expansion of land under agriculture—which has sustained agricultural growth in the past, as explained above—is placing pressure on national parks and preserves on which the tourism economy is based.

Drought Stages and Impacts

Unlike other natural hazards, although droughts are normal, recurring features in virtually all climatic zones, the effects of droughts often accumulate slowly over a long period and may linger for years afterwards. As discussed in Section I, the onset and end of a drought are difficult to determine. Unlike earthquakes, floods, or hurricanes, the impact is mostly non-structural and can be felt in large areas and by large numbers of people. Finally, the absence of a precise definition of drought adds to the confusion both in terms of recognition and degree of severity.[31] Four types of droughts are identified, and their relationship is illustrated in Figure 19 (see definitions in Section I).

[29] UNHS, 2009/10.
[30] UNDP/NEMA/UNEP, 2009.
[31] Wilhite (2000).

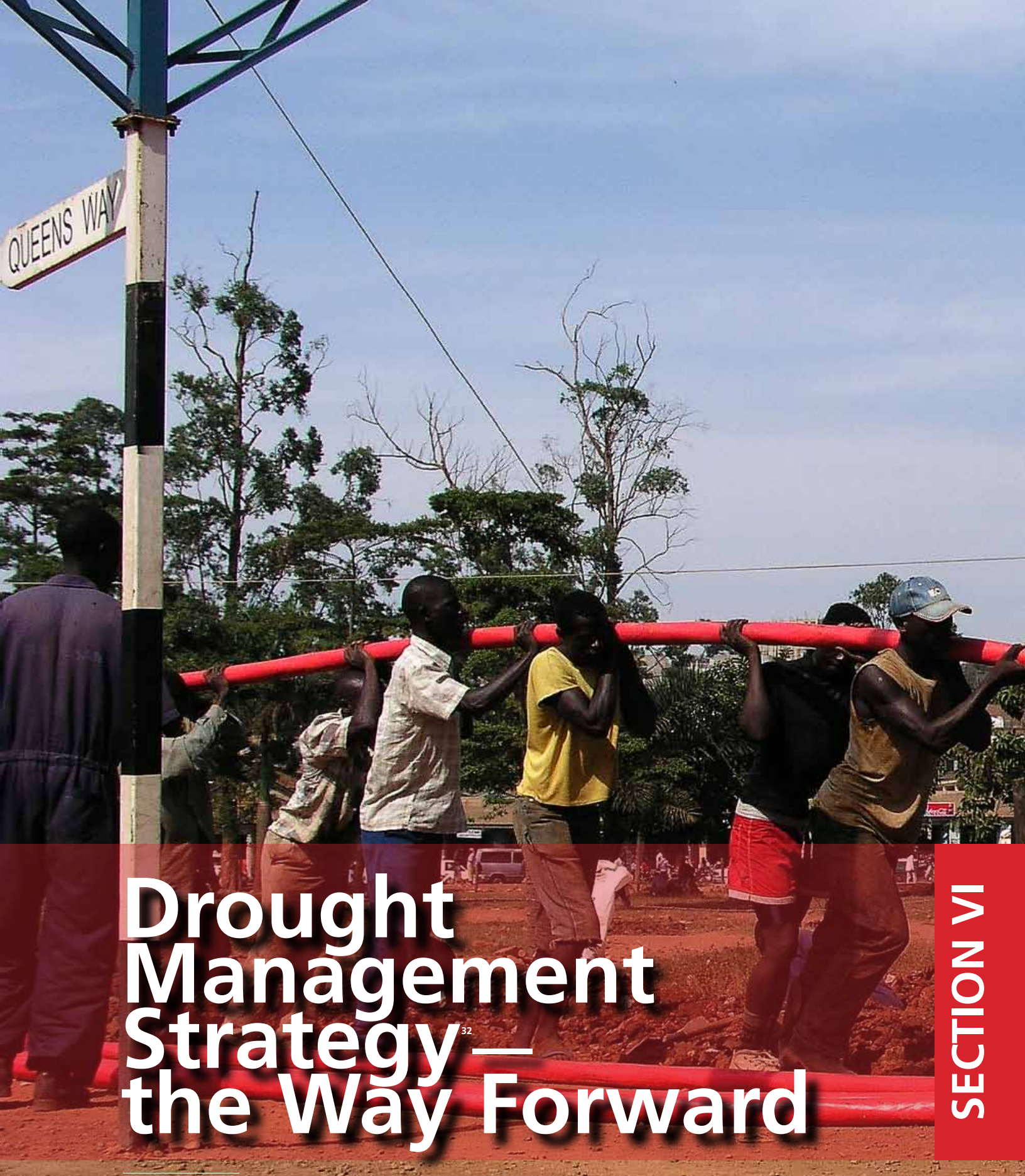
Figure 19: Drought stages and impacts



Source: UNISDR, 2009.

Droughts can have many impacts, including:

a) Human deaths and/or decline in human health
b) Animal deaths and/or decline in animal health
c) Decline in crop area, yields and production (both cash and food crops)
d) Decline in animal yields and production (milk, meat, and wool)
e) Decline in fish yields and production, both capture and aquaculture
f) Decline in the quality of agricultural produce
g) Decline in livelihood opportunities in rural areas
h) Decline in income of farmers and pastoralists
i) Decline in agricultural exports and export earnings
j) Decline in government revenue and an increase in expenditure for agriculture
k) Decline in the quality of top soil and soil fertility
l) Increased incidence of crop and animal diseases, pests, and vectors
m) Decline in employment in rural areas
n) Decline in food security (for both rural and urban households)
o) Increase in rural poverty.



SECTION VI

Drought Management Strategy[32] — the Way Forward

[32] Drought Risk Management Strategic actions can be adapted for general Disaster Risk Management. This section can be treated as a stand-alone section for disaster risk management strategy.

The goal of a drought risk management strategy is to promote the adoption of preventive or risk-reducing mechanisms that reduce the impact of future drought events. A drought management strategy, especially as a part of an overall multi-hazard risk management approach, can reduce vulnerability factors and increase the coping capacity of the affected population.

Institutional mandate

The mandate for disaster preparedness and management lies with the Department for Disaster Preparedness, Relief and Refugees (MDPRR) within the Office of the Prime Minister (OPM). The Department of Disaster Preparedness and Relief (DDPR) coordinates activities of the various line ministries, humanitarian agencies, and stakeholders concerned with victims of disasters in order to achieve a multi-sectoral and harmonized approach to disaster management. The National Platform for Disaster Preparedness and Management/Inter-Agency Technical Committee coordinates preparedness, prevention, mitigation, and response interventions in the country. At the district level, this mandate lies with the District Disaster Management Committees (DDMC). The National Emergency Coordination and Operations Centre (NECOC) is responsible for the technical aspects of coordinating emergency and disaster responses in Uganda.

In response to the growing risks associated with disasters, the Government has made efforts to reduce vulnerability due to natural and human-induced hazards. The following instruments have been developed and approved for implementation: The National Policy for Internally Displaced Persons, 2004 and The National Policy for Disaster Preparedness and Management, 2010. Furthermore, an interagency forum for peace building and conflict resolution was established. However, the performance of the disaster management sector is constrained by factors such as: the inadequate policy and legal framework for disaster preparedness and management, poor early warning systems largely due to inadequate meteorological services in the country, very low capacity for mainstreaming disaster risk reduction at both the national and local government and community levels for resilience plans and actions, and lack of data on damage and losses on which costs and estimates for recovery needs are based.

Drought Risk Management Action Plan and Recommendations

In order to plan effectively for drought risk management within an overall disaster risk management framework, three areas of actions are suggested. These areas, which are discussed in greater detail below are:

a) Strengthening institutional capacity to manage disasters,

b) Building community-based preparedness and resilience, and

c) Mainstreaming resilience through interventions in key sectors.

It is recommended that this Disaster Management Strategy be implemented through a Disaster Assessment and Resilience Action Plan (DRARAP), which shall be implemented as a project. The Plan will help transform the country's current disaster response approach to a proactive disaster risk management as well as disaster risk reduction approach that can help reduce Uganda's general level of vulnerability to natural and man-made disasters. Once finalized, the Plan shall be implemented as a project with components on: Mapping National Vulnerability and Disaster Risks; Building Community Resilience; Mainstreaming Disaster; Risk Resilience in All Sectors; Evaluating Risk Resilience and Measuring Progress toward Building Resilience as well as Capacity Building in Disaster Management. The plan could also benefit from ongoing regional efforts to build resilience in the Horn of Africa (Box 3).

Box 3: Benefitting from regional actions: drought resilience in the Horn of Africa

Even though conditions have generally been improving, impacts of the recent drought on the Horn of Africa are still being felt on a large scale. As of March 2012, the total number of food insecure people in the drought-affected countries of Ethiopia, Djibouti, Kenya, and Somalia had dropped from a peak of 13.3 million people in late 2011 to around 9 million people. Somalia remains the most stressed, with 31 percent of the people in the country still in crisis even with the famine recently declared to have ended. Affected areas are home to one of the most vulnerable and at-risk populations, with drought resulting in migration and displacement and the number of drought-affected refugees from Somalia increasing in refugee camps located in Ethiopia and Kenya. More than 380,000 drought-affected refugees have entered the two countries via the Kenya/Ethiopia Somali borders.

As a response, many donors and regional organizations, including the World Bank, are not only providing relief but also coordinating their actions to bring drought resilience in the region. The World Bank, in close consultation with the national governments, regional organizations such as IGAD and the AU, as well as development partners, prepared a Horn of Africa Drought Response and Resilience Plan in August 2011. The plan supports affected countries through a US$ 2.2 billion financing package. The plan integrates three phases: rapid response, focused on high-impact operations to strengthen safety nets and recovery over the next six months; economic recovery, focused on livelihood recovery, restoration of livestock production, resilience, and preparedness over the medium term; and drought resilience activities over the next five years, focused on risk financing, investment in drought resistant agriculture, and climate-resilient investments.

Regional interventions that will have lasting impacts on droughts in the Horn and that can potentially benefit Uganda are: (i) open data for resilience platform—an initiative of many donors, this platform is currently housed in RCMRD, Kenya and provides spatial data on drought severity, vulnerability, and donor support programs; (ii) support for improving regional hydro-met and climate outlook—IGAD is being supported to improve technical abilities to provide timely and accurate climate outlook information; (iii) regional livestock project supported by the World Bank, AfDB, and others, which will benefit the pastoral population of Kenya, Ethiopia and Uganda; and (iv) other regional initiatives focusing on improving drought risk financing, drought needs assessment, and water management.

A. Strengthening institutional capacity to manage disasters

The capacity of the institutions that deal with disaster management needs to be strengthened substantially and mainstreamed in the key line ministries. This would require formulating the appropriate legal framework, designing DRM policies, and strengthening relevant institutions through capacity building programs. This must be accomplished at the national, district, and local government levels. A robust institutional system would be one that plays a key role in monitoring, declaring, responding to, and mitigating drought, while providing a platform to coordinate activities of different government agencies active in the different phases of the drought. An example of the institutional framework used to manage drought in India and as a potential guide to Uganda, is provided in Box 4.

Institutional capacity building may include the following components:

- ***Undertake institutional mapping and gap analysis:*** Sustainable DRM requires effective coordination between the sectors that create the policies and the local communities that implement them. For the relevant sectors identified in component two, this activity shall map the institutional connections and identify the gaps for

Box 4: Drought management framework in India

The Government of India has devised many short-, medium-, and long-term strategies to mitigate and overcome adverse effects of drought, and it has implemented relief and development programs in cooperation with the concerned states. These measures include: ensuring availability of food grains and fodder, judicious use of surface and groundwater, prevention of migration of cattle camps, appropriate selection of crops, cropping sequences and agronomic practices, promotion of subsidiary income of the affected people, and employment generation in rural areas.

Monitoring and declaration are important components of disaster management and governance in India. Drought declaration is announced when the rainfall is –20 percent to –59 percent (early warning), –60 percent to 99 percent (drought), and –100 percent (severe drought) of normal conditions. The Drought Management Group, under the chairmanship of the Cabinet Secretary, coordinates the efforts to deal with drought in various states. The members are Secretaries of the Ministries of Agriculture, Rural Development, Food, Woman and Child Development, Railways, and Drinking Water Supplies. The National Disaster Management Cell monitors the drought situation in different states and resource availability (under the Ministry of Agriculture, Government of India). The National Centre for the Calamity Management (NCCM) under the Ministry of Agriculture was established to monitor all types of calamities and make recommendations about the extent of assistance to be released to individual states from the NCCM. Presently, the National Calamity Contingency Fund from the Government (under the Ministry of Home Affairs) deals with calamities of severe nature. The National Agricultural Drought Assessment and Monitoring System, 1989 provides scientific information at the district level for most of the states and at sub-district levels in a few states. The Drought-Prone Area Development Programme and Desert Development Programme use the plans prepared on the basis of the integrated estimation. Research institutions like the International Crops Research Institute for Semi-arid Tropics; Central Arid Zone Research Institute; Indian Grassland and Fodder Research Institute; Central Soil Salinity Research Institute; Indian Council of Forestry Research and Training; and those under the Indian Council of Agriculture Research provide information on various aspects of drought management.

Source: Gupta et al, 2011. "Drought disaster challenges and mitigation in India: strategic appraisal" Current Science Volume 100 Number 12.

effective risk reduction in that sector. Furthermore, it shall make recommendations to strengthen existing institutional frameworks such as the National Platform.

- ***Integrate DRM in the National Development Plan (NDP):*** The NDP is the main planning instrument for the Government of Uganda. It articulates the national government plans for all the economic sectors and establishes priorities. In order to ensure that DRM is given the importance it deserves, DRM should be integrated and incorporated in the NDP as well as development plans at lower levels.
- ***Prepare and simulate national and district DRM plans:*** To ensure that the country is fully prepared to address any future disasters, national and district-level DRM plans need to be formulated. These plans must then be simulated by the responsible authorities and fully tested. Budgetary resources to implement these plans must also be assured in case a disaster occurs. This needs to be supplemented with the development of community-based DRM plans, and communities need to be mobilized and organized to implement them when a drought (or any other disaster) happens.
- ***Undertake a National Risk Assessment:*** This activity will quantify the magnitude and frequency of natural hazards and their associated impacts and aggregate these results for each district within

the country. It will provide the foundation for the prioritization of risk reduction interventions and support national decision-making processes. It shall be used for a range of activities including, but not limited to, planning, communication, and capacity building purposes.

- ***Produce a National Risk Atlas:*** The National Risk Atlas shall compile the National Risk Assessment into an easy-to-read publication that can be used to build understanding of the prevailing risks and hazards within Uganda at the district level.
- ***Develop an Open Data for Resilience Database:*** The database is the collection of the data and maps produced throughout the Risk Assessment into a platform that is easy to use and maintain. This platform shall be accessible both online and offline.[33] This National Risk Database shall also be deployed and thus supported within the framework of the Open Data for Resilience Initiative (OpenDRI).[34] All data subsequently produced from other DRARAP components shall be added to this Risk Database.
- ***Collect, process, and disseminate quality data on DRM:*** At present, it is very difficult to obtain quality data that is complete, consistent, and accurate. The DRM institutions must be made responsible for collecting all the relevant DRM data, processing it, then disseminating to all the relevant institutions in the country, including the UBOS. It is very difficult to make DRM policies and plans in the absence of quality data. The objective is to effectively monitor and evaluate Uganda's progress toward building resilience and to have relevant data to support sectoral disaster risk reduction activities. The following specific activities are suggested:
- ***Assess the National Household Survey:*** An assessment is needed of the National Household Survey's ability to capture relevant information to inform the National Disaster Risk Management strategy, the sectoral DRM strategies, and the National Resilience Index.
- ***Establish a Damage and Loss Assessment (DaLA) Database:*** Building upon the 2011 DaLA that assessed the damages and losses due to rainfall variability, a DaLA database needs to be established to record those results and results from future assessments. These data shall be further processed to inform the national DRM strategy.
- ***Develop a National Resilience Index:*** From the National Household Survey and other government data of equivalent reliability, a National Resilience Indicator should be constructed to measure the country's progress toward disaster risk reduction and disaster preparedness.
- ***Establish an effective early warning system:*** An effective early warning system is a vital part of the drought risk reduction strategy. Many countries such as Botswana are able to quickly reduce the impacts of droughts and reduce human loss thanks to effective early warning systems (see Box 5). At present, Uganda does not have an early warning system to predict the onset of any disasters, including drought. In the absence of properly functioning stations as illustrated in Table 37, it is very difficult to generate credible data for a national early warning system. Consequently, the Department of Meteorology, which is part of the Ministry of Water and Environment, needs to be strengthened so it can provide the necessary information. However, it is extremely important to ensure not only that this department provides a "public good" function but also that the services are demand-driven, in the sense that it provides all the necessary data to all the economic sectors (both public and private) in a form that the likely users need. Substantial strengthening of this department is needed through (i) training of staff,

[33] The preferred platform for this is the GeoNode. The GeoNode is a GIS-based web platform designed to make the presentation and sharing of geospatial data simple. The package is built upon free and open source software and is built upon OGC standards. For more information please visit www.geonode.org.

[34] OpenDRI (OpenDRI.org) is a global program supported by the GFDRR that encourages the sharing of risk data for effective decision making to build community resilience.

(ii) installation of new and improved equipment, and (iii) rehabilitation of the existing non-functional stations. Notably, a well-functioning Department will also facilitate the development of much needed drought maps for Uganda, along with agro-climate and crop maps.

Table 37: Meteorological capacity in Uganda

Type of Station	Existing Stations	Operating Stations	Remarks
Synoptic	12	12	Below capacity
Agro-meteorological	16	8	Lack of personnel and instruments
Hydro-meteorological	14	5	Lack of office, personnel and instruments
Rain Gauge	250	35	Volunteers not available
Automatic Weather	41	6	Lack of inspection and servicing
Upper Air	1	0	No hydrogen generator and consumables

Source: Identified by assessment team

Box 5: Drought Early Warning System in Botswana

Botswana is a landlocked southern African state with common borders with Zimbabwe, South Africa, Namibia, and Zambia. Being an arid and mainly desert country where rainfall is generally low and erratic, the country is consistently under threat of drought. Realizing that drought is a recurrent phenomenon that requires planning ahead of its occurrence, the Botswana Government established institutions in relevant government ministries to deal with various aspects of drought management. Aware that a functioning early warning system is critical in disaster-prone countries, the Government also formally established a Drought Early Warning System (EWS) in 1984 to enhance drought preparedness, mitigation, and response.

The EWS relies on a variety of data and indicators related to human nutrition, agriculture, rainfall, and climate to assess drought risk. The resulting drought risk assessments are used to produce monthly and annual reports. The reports are then used by government decision makers to monitor the situation and, when appropriate, formally declare drought. Once drought is declared, food relief is delivered to affected communities within days, with all ministries and local authorities mobilized to assist.

The Drought EWS enables the Government to act quickly to reduce the impact of drought. Since the implementation of the EWS, Botswana has suffered no human loss due to drought. The EWS is also credited with saving the Government and individual households money by minimizing economic losses.

Source: UNISDR, 2009. *Drought Risk Reduction Framework and Practices: Contributing to the Implementation of the Hyogo Framework for Action.*

Short, Medium, Long-term

In the short term, several preparatory actions are suggested, namely: (i) development of the national risk atlas and report on probable damage and losses of the district by sector; (ii) institutional mapping and gaps assessment to assess coordination between relevant agencies, legal basis for risk reduction, capacity building needs, and budgetary gaps; (iii) assessment of the quality of meteorological, weather, and disaster risk data needed for early warning, gaps in transfers and exchanges between districts, regions, and national levels, and how early warning information is used for disaster preparedness.

In the medium to long term, numerous actions are needed to enhance disaster preparedness and climate change adaptation at the national, regional, and

community levels, such as: (i) national and local disaster preparedness and capacity building targeting areas most prone to disasters as identified in risk mapping, clearly identifying institutional roles and resources, information processes, and operational arrangements for specific actors at times of need; and (ii) integrated data management and dissemination system development contributing to improvement of data quality, and transfers and exchanges between districts, regions, and national levels. This will ultimately result in a strengthened and effective early warning system.

B. Building Community-Based Preparedness and Resilience

Increasing community resilience is at the heart of drought risk management strategy. The resilience of Uganda to disasters at the community level depends on utilizing the right information, strengthening national and local capacities, and implementing targeted activities that seek to make practical changes at the community level. The following actions are suggested:

a) ***Conduct district-level Risk Assessments*** **and** ***Community Vulnerability Assessments***. This activity will identify the primary sources of vulnerability and roadblocks to resilience at the community level.

b) ***Develop Community Resilience Plans*****:** The district-level Risk Assessment and Community Vulnerability Assessment will be used to develop a Community Resilience Plan. This plan will provide the basis for land planning, disaster risk reduction interventions, and disaster preparedness activities, as well as support other local decision-making. The planning document shall develop a process to identify key opportunities for the community to reduce natural hazard risk and build resilience. Specifically, it should:

- Review previous and existing community plans;
- Produce community land use maps for planning purposes;
- Define gaps and opportunities for early warning systems;
- Review existing institutional structures, identify the gaps, and make recommendations to strengthen these structures; and
- Identify potential Community Resilience Activities so the community and government can invest in building resilience.

b) ***Undertake Community Resilience Activities*****:** Within these districts, 2-3 disaster mitigation and prevention activities shall be designed and implemented and the impacts monitored. The successful activities that demonstrate effective change shall be packaged to be easily reproducible in other parts of the country.

- **Community Resilience Activities:** These activities will target groups of 5-8 families to complete practical works such as terracing sloped agricultural land to reduce landslide risk and using nursery bases to grow trees and grasses ideal for land stabilization.
- **Community Resilience Activity Toolkits:** When Community Resilience Activities are demonstrated to be effective and economical, they shall be packaged so they are easily reproducible throughout other areas of the country. These toolkits should consist of simple-to-use materials that communities themselves can use to replicate the activities, as well as materials to enable the government to reproduce these activities in other parts of the country.

Short, Medium, Long-term

In the short term, it is suggested that the activities in all three areas described above be implemented, while in the long term, community-based drought resilience plans should be implemented and monitored. The long-term phase would include implementation of priority investments from district drought resilience investment plans. The investment model would be based on the 'participatory co-investment model' already applied for rural water supply conditional grants. The MAAIF, MWE, Local Government, and User Committee Program Coordinators will monitor

and evaluate implementation. The User Committee will eventually be responsible for maintenance and use of the community resources.

The Drought Cycle Management (DCM) concept can be used while planning for Community Based Disaster Risk Reduction. The DCM model (widely used and refined by various agencies since the 1980s) has been designed to identify appropriate activities for each phase of the drought cycle given the situation on the ground: normal, alert, emergency, and recovery. The current DCM model has become increasingly accepted as the dominant drought management model in the region and ensures a flexible drought response while integrating relief and development activities in a holistic way. The DCM is a very suitable tool for mainstreaming Disaster Risk Reduction activities in the pastoral/dry lands livelihood context, especially through the Community Managed Disaster Risk Reduction (CMDRR) approach which builds on the communities' own strengths and contributes to enhanced ownership of the process and its outcomes.

C. Drought risk mitigation in key sectors

Recommendations for Agriculture

In order to minimize the impact of drought in the agriculture in the long run, there is a need to strengthen drought risk management[35] and build drought resilience. The necessary DRM actions for strengthening drought (disaster) risk management for agriculture in Uganda are summarized in Table 41 later in this section, along with the indicative cost of each action, responsible government agency, and potential funding sources. Some of these actions are discussed briefly below.

a) ***Reduce degradation of agricultural land:*** Degradation of agricultural land appears to be a serious problem in Uganda. According to the latest information, on average, loss of top soil is about 5 ton per ha annually. Through this, annual loss of plant nutrients in terms of kg/ha is about 85 for N, 75 for P2O5 and 10 for K2O. On average, the application of chemical fertilizer is about 1 kg/ha. Under these circumstances, it would be very difficult to increase crop productivity. This would not only require expanded use of manure and chemical fertilizers but also the implementation of Sustainable Land Management (SLM) as well as Sustainable Land and Water Management (SLWM) techniques. Otherwise, the natural disasters (drought, floods, and landslides) will make it very difficult to increase agricultural production over time and will make farming less and less disaster resilient and environmentally sustainable. The implementation of SLM and SLWM techniques will also improve the capacity of land to absorb and hold more water over time. In other words, SLM and SLWM will not only improve soil fertility but will also improve soil moisture.

b) ***Bring more cultivated area under assured irrigation:*** Even though almost 200,000-450,000 ha of cultivated area is suitable for irrigation, less than 10 percent (about 15,000 ha currently) is actually irrigated. Uganda is blessed with large amounts of fresh water that are not fully developed or utilized for promoting economic development in the country. There is not only an urgent need to develop the water sector (Bank is already working with the Ministry of Water and Environment in preparing a Water Management and Development Project), but there is also an urgent need for ensuring that water is made available to farmers (most of whom are smallholders) for surface irrigation. Developing the irrigation system will not only build drought resilience but also improve national and household food security by increasing agricultural productivity (by facilitating the use of modern agricultural inputs) and reducing rural poverty.

c) ***Promote adaptation of climate-smart agriculture:*** To promote disaster resilience in agriculture, there is a need to select, catalogue, test, demonstrate, and disseminate climate-smart agricultural technologies and practices. These technologies and practices can be obtained

easily from the shelves of the national research institutes, international agricultural research institutes (such as IITA, CYMMYT, ICRISAT, ILRI and African Rice center), and neighboring countries in East Africa. These climate-smart technologies and practices will also increase agricultural productivity, food security, and farm household income. The national agricultural research and extension system also needs to be strengthened so they are able to develop and disseminate drought-resistant crop varieties for important food crops.

d) ***Strengthen food safety and food security:*** As indicated earlier, a large share of Uganda's population is food insecure, even without a drought. The occurrence of a drought (or any other disaster) further aggravates the situation and makes it very difficult for the affected population to meet their food needs. While the Government has plans that provide food assistance to the affected population, there is a need to rationalize food safety programs and modernize the agricultural sector to improve food security at the national and household levels.

Recommendations for Pastoralist community development

The vulnerability of pastoralists increased with the water deficits of 2010-2011, because the animals they depended on became sick or died due to drought. Pastoralists in Uganda and particularly the Karamoja sub-region rely primarily on livestock: cattle, sheep, camels, goats, and donkeys. They move from place to place in search of pasture and water, usually during drought periods. Some of the Karamojong are agro-pastoralists with crops like sorghum forming part of their production system. During a drought, some family members move with animals but others (often the women) live permanently near their crops. The rainfall deficit situation of 2010-2011 caused losses to livestock production, moreso in pastoral areas. The prices of animal fell over large areas, and pastoralists found few alternatives to sell their animals. At the same time, the prices of grain fell, making it more difficult for people to buy grain. Livestock losses were estimated at 1,020.3 billion Shillings or US$ 428.2 million.

The following short-term interventions are suggested in this area:

a) ***Improve the functioning of the markets:*** Poor trade outlets during droughts make it impossible for pastoralists to sell their animals, and farmers find it difficult to sell their grain. Barriers to trade include: (i) health requirements, (ii) restrictions on cross-border trade, (iii) lack of markets, (iv) transport facilities, (v) poor market information, (vi) poor transport facilities and poor roads, among other things. Reducing barriers to the functioning of markets will go a long way in improving the coping mechanisms of the pastoral communities.

b) ***Promote household income diversity:*** Households with several sources of income generally have more secure livelihoods during a drought. However, few alternative sources of income opportunities are available in the dry lands, making people unable to protect themselves during a drought. Alternative sources of income may include: (i) minerals, (ii) wild plants, (iii) farming, (iv) casual labor in urban centers, (v) petty trade, (vi) weaving and handcrafts, (v) tourism, and (vi) cash-for-work and food-for-work schemes. Income diversification schemes should be suited within the drought cycle to enable different categories of vulnerable people to participate in the schemes.

c) ***Improve water availability and quality:*** Water is scarce in pastoral areas, as they are arid and semi-arid. There are a few perennial rivers, and many of these seasonal rivers have sporadic, sometimes disastrous floods. Other water sources include deep and shallow wells, dams, and surface tanks. The rainfall is low, erratic, and scattered. Most water sources in Karamoja are community-managed and are mostly seasonal, forcing people to move in search of water during drought. The traditional sources of water in

Karamoja include: (i) shallow groundwater from temporally wells in river beds; (ii) large or small pans which hold water for up to three months after the end of the rains; and (iii) springs in hills and forests. Semi-permanent sources with manual or mechanical pumping systems also exist near settlements, including boreholes, piped gravity schemes in urban centers, and excavated wells. Most of these sources have management challenges.

Risk reduction strategies should focus on bringing water closer to households to reduce the time needed to fetch it. The interventions should aim to support livelihoods by ensuring that sufficient water is available to meet basic needs, which include water for livestock or crop production. Focusing on domestic water needs may save lives in a drought, but if water interventions don not support livelihoods (including livestock), people will have no long-term mechanisms for survival. Drought risk reduction strategies in the water sector should include:

- Promote water harvesting and storage,
- Strengthen water management,
- Plan for new sources of water,
- Maintain traditional water sources,
- Educate people on hygiene and sanitation,
- Plan for contingencies, and
- Update an inventory of existing water sources and use this as a tool to plan water interventions.

d) ***Help cope with malnutrition and disease:*** Malnutrition is always a problem in Karamoja during a drought. Malnutrition and disease cause suffering and low productivity and mean that pastoralists cannot move in search of fresh pastures. Few veterinary services exist in the area, and livestock disease is also a major problem as it reduces animal production during drought. Challenges include: (i) inadequate veterinary services, (ii) inadequate supplies of drugs and vaccines, (iii) cost of veterinary services, (iv) under-developed private veterinary services, and (v) high cost of providing animal health services.

Drought risk reduction strategies for malnutrition and disease include:

- Diagnose and treat animals for various diseases;
- Monitor and report outbreaks of serious diseases;
- Train community-based animal health workers;
- Establish a common approach to disease control and management of drugs;
- Develop and maintain water points;
- Diversify herd species;
- Build and repair cattle dips;
- Vaccinate, de-worm, and spray to control disease and parasites; and
- Conserve and protect pasture using traditional rules and regulations and range management approaches.

e) ***Improve education:*** Consistent with other dry land areas, the people of Karamoja are less educated compared to the rest of the country. They find it difficult to qualify for jobs in the formal sector; cannot access information about markets, networks, and new technologies; and lack voice to influence policies that affect them. The children are particularly less-educated. To address this challenge, the Government has developed mobile schools in Karamoja. Each cluster of about four manyatas has mobile teachers—normally secondary school drop outs from the community—who live with the community and teach children to read and write. They use a pastoralist-friendly syllabus designed for alternative basic education for Karamoja. The program has no age limit, so many of the students are adults. Interventions in this area may include:

- Continue to strengthen Alternative Basic Education for Karamoja (ABEK);
- Promote education for girls and provide special facilities for them (e.g., timing of lessons to suit their work patterns);
- Train professionals, preferably from the community itself, who can move with people when they migrate;

- Expand education facilities and build additional boarding facilities to handle extra students;
- Persuade parents to enroll their children in school;
- Develop out-of-school programs for out-of-school youth, adults, and elderly;
- Strengthen parent-teacher associations;
- Ensure that food is available during drought; and
- Ensure that water is available at schools.

Long-term actions call for strengthening local institutions and welfare systems. Generally, local governments in Karamoja are weak and inadequately staffed. Such systems are unable to cope in the face of a severe drought. In addition, there are no private insurance schemes in Karamoja. The traditional informal arrangements within families, clans, and communities that help people cope with drought are also weak and are breaking down, especially with insecurity in the most recent past. The existing formal community organizations and NGOs depend almost entirely on outside aid. In the long run, strengthening local institutions and putting predictable safety nets in place to support the welfare of the people during drought should be long-run priorities.

Recommendations for Water resources development

The development and management of water resources is intimately linked to Uganda's continued ambitions to sustain economic growth and reduce poverty. Compared with other countries in Eastern Africa, Uganda as a whole is well-endowed with water resources.[36] However, aggregate annual figures mask both seasonal and spatial variability, which translate into significant geographical disparities in per capita water availability and, consequently, use. A further complicating factor is that Uganda shares nearly all its water resources with other countries, particularly those of the Nile.

Limited development of water infrastructure and inadequate water management, coupled with the natural challenges of hydrological variability and shared water resources, have resulted in poor utilization of water and unmet demands, water quality problems, and high vulnerability to water shocks. High vulnerability to climatic and hydrologic variations has undermined the country's efforts to sustain economic development and reduce poverty. Two factors are expected to place additional pressure on Uganda's water resource base: increasing demands for water and the impacts of climate change. The location and timing of available water supplies will become a greater challenge with economic growth, population increases, and urbanization and could lead to conflicts over competing demands. The potential impacts of a changing climate are not fully understood, but it is likely that the intensity and frequency of extreme events—including floods and droughts—will increase.

The following interventions are suggested for water resources development:

a) ***Rehabilitate water points:*** According to the Uganda Water Assistance Strategy, Uganda has about 1,000 water points (301 dams and 750 valley tanks). These water points were developed primarily for livestock. Unfortunately, only about 26 percent of them are actually functional at present, so as a consequence, less than half of the water requirements for livestock are met. Rehabilitation of these water points is absolutely essential for addressing the drinking water problem for livestock owned by farmers as well as pastoralists. Furthermore, since Uganda is rich in groundwater resources, there is also a need to install tube wells for providing drinking water to livestock as well as for crop irrigation. Furthermore, pastoralists need to be integrated into local communities and farming systems.

b) ***Increase priority investments in 'water for livestock,'*** including constructing 25 new

[35] Total annual renewable water resources in the country are estimated to be 66 BCM, which constitutes about one-third of the total renewable freshwater resources in the region and corresponds to about 2800 m3/person/year.

valley tanks and increasing water storage through surface water reservoirs, gravity flow, or groundwater exploitation.

c) ***Strengthen soil and water conservation programs:*** This is key to ensuring drought resilience and can be achieved through the construction of community-based small dams and soil conservation works in drought-affected areas. Watershed management programs and planning should also be encouraged.

d) ***Improve watershed-based land use planning:*** Watershed-level planning to make effective land use decisions that preserve wetlands and other water resources will be important.

e) ***Encourage sustainable use of ground water resources:*** Uganda's groundwater resources are substantial in relation to available surface water apart from the Victoria. Estimates of total groundwater use in 2030 indicate that only about 15 percent of this resource will have been tapped, suggesting that groundwater may also be used as a drought reserve without threatening drinking water supplies. The presence of aquifers is highly variable as are well yields, necessitating very detailed local-level planning for the exploitation of groundwater in Uganda. A sustainable ground water development framework should be developed, ensuring adequate recharge of aquifers and exploitation of ground water resources during drought crises.

f) ***Mainstream climate resilience in water resources planning and management:*** including risk profiling and building capacity to incorporate risk and uncertainty in planning and management (e.g., developing analytical tools and guidelines, likely focusing on a few select water-dependent sectors that are particularly vulnerable to climate variability and change, such as hydropower and agriculture).

Strengthen forecast and early warning systems by strengthening the hydrometereological monitoring system, observation points, and capacity building of hydro-met services.

Recommendations for Energy

The Government of Uganda has slowly but steadily taken up opportunities for developing the energy sector. The rainfall deficit situation in 2010-2011 raised the costs of electricity generation for Uganda in proportion to the shift toward thermal power generation. Even though electricity generation in Uganda is largely based on hydropower, the large majority of energy consumed in Uganda is in the form of fuel wood (biomass), which has led to widespread deforestation and watershed degradation. Current hydropower capacity in Uganda is less than 250 MW out of a potential of more than 2200 MW. Two large hydropower projects (Bujagali and Karuma) are expected to increase hydropower capacity.[37] Since the current and future hydropower plants located at the outlet of Lake Victoria or downstream are controlled through the same outlet, power production effectively depends on water levels at Lake Victoria. Here water releases are governed by an "agreed" curve. Since all future hydropower developments are hydraulically linked to Lake Victoria and its water level, Uganda's energy sector may become even more vulnerable to climatic variability in the future. Overall, the hydraulic risk for hydropower production along the Nile is at increased risk due to climate variability and lack of knowledge.

In the medium term, a Lake Victoria Basin knowledge base, monitoring, and decision support system—particularly with respect to managing water releases—will improve water level management and optimize hydropower generation. This should ideally be set up on a regional scale involving Kenya, Uganda, and Tanzania. Since a decision support system is only as reliable as the input data, the hydrological monitoring network of the main tributaries to Lake Victoria as well as a sufficiently dense and reliable real-time meteorological monitoring network need to be established and strengthened in parallel. Such a monitoring and decision support system will support

[37] World Bank (2011).

managing surface water use to improve hydropower production and consider tradeoffs and synergies with multiple uses.

In the long term, investments to diversify and sustain power and hydropower generation are needed to meet the growing demand and to ensure that energy generation is less affected by climate variability. For example, possible investments could be in mini- and micro-hydropower generation, particularly along secondary streams to meet extra demand from the private sector (irrigated agriculture) and provide electricity to off-grid rural communities. Furthermore, improving catchment management, targeting deforestation—particularly with regard to the extensive use of firewood—and sustainable land management will have a positive impact on Lake Victoria in the long run.

Recommendations for Environment

Over the last couple decades, an alarming trend of environmental degradation can be observed in Uganda, including a decline in forest and grassland cover, degradation of wetlands, and expansion of built-up land and farmland. The largely unsustainable use and over-exploitation of these natural resources has contributed to substantial environmental degradation and is one of the main driving forces of Uganda's vulnerability to natural disasters. Vulnerability not only to drought but also to landslides and floods can directly be linked to the environmental degradation. For the main environmental systems in the country, the following trends and causes can be observed:

- **Forests:** Several studies document a substantial loss in forested areas, with an estimated 27 percent—roughly 1.3 million hectares out of 5 million hectares—being lost between 1990 and 2005. The major causes of deforestation are provision of wood fuel and clearing of land for agricultural activities. About 90 percent of the rural population depends on firewood, while a large fraction of urban dwellers depends on charcoal.
- **Grasslands:** From 1990 to 2005, the grassland cover declined by an estimated 20 percent.[38] Uganda's wet and dry grasslands are found largely in the cattle corridor, where they are an important element of the local livelihood systems but have generally been affected by overgrazing and overstocking.
- **Drylands:** Uganda's drylands also lie in the cattle corridor, with an area of approximately 84,000 km^2.[39] The major problems in Uganda's dry lands include overgrazing, deforestation, unsustainable farming systems, uncontrolled wild fires, land tenure, and limited access of pastoralists to grazing areas.
- **Wetlands:** Wetland areas currently stand at about 11 percent of total land area, having declined by 17 percent from an estimated 32,000 km^2 in 1964 to about 26,640 km^2 in 2005. This is a serious concern not only in terms of impacts on rich ecological resources, but also in terms of the loss of important wetland functions (e.g., natural drainage, flood retention, and water quality improvement) and wetland products.[40]

The trend in degradation is fueled by sub-standard crop and animal husbandry practices, overgrazing, population pressure, and uncontrolled development. Overstocking or overgrazing and deforestation as well as consequent soil erosion are some of the main driving processes.[41] Overstocking and overgrazing made Kotido, Moroto, Mbarara, and northern Luwero districts particularly vulnerable to soil erosion. Water erosion is also severe in Mbale, Kabale, Kabarole, Kapchorwa, Bundibugyo, and Kasese districts where mountain slopes have been heavily

[38] NEMA (2007).
[39] NEMA (2007).
[40] World Bank (2011).
[41] Overstocking occurs when stock levels exceed the rangelands' carrying capacity, implying reduction of forage below the biological minimum. The resulting effects of overgrazing include soil compaction, erosion, and emergence of low-value grass species and vegetation with subsequent further decline in carrying capacity, lower productivity, and higher vulnerability to drought.

deforested. In these areas, as a consequence of heavy rains, landslides occur as an even more severe form of erosion.[42] NEMA (2007) states that one of the underlying causes of degradation is the abandonment of soil and water conservation practices such as terraces, embankments, and strip cropping that were promoted during the immediate post-independence period. Similarly, in many other parts of the country, the majority of farmers have inadequate knowledge or few opportunities to learn about improved farming methods. Improved land husbandry strategies such as agro-forestry, fuel-wood, and fodder lots have not yet been promoted widely.

Thus, addressing environmental degradation needs to be an integrated part of the strategy for disaster risk reduction in Uganda. Deforestation and unsustainable use of grazing land need to be addressed in a comprehensive effort that brings together governance and enforcement of environmental regulations, promotes appropriate production methods through extension services, and actively invests in afforestation, soil and water conservation, and agro-forestry systems. Sustainable access to land and appropriate land tenure regimes may be one of the main drivers but also needs to be addressed carefully to reach a mutually agreeable consensus. As an immediate measure, the promotion of sustainable land and pasture management practices through district extension services needs to be advanced substantially. Strategies to be promoted may include the promotion of different agro-forestry systems suitable for agro-pastoral communities and adapted to the different ecological zones. In dry lands, the plantation of fodder and fuel-wood trees such as *Moringa oleifera,* with a preference for indigenous trees, in hedges or small wood lots can be promoted as a low-cost strategy. Access and extension services can be provided through district and village nurseries distributing seedlings to the local communities.

D. Summary of Selected DRM Activities and Conclusion

The following table provides a summary of the suggested DRM strategy with indicative costs for some strategic activities and categorizes them as short, medium, and long-term measures.

E. Conclusion – 10 Steps for Implementation and Mainstreaming

This section concludes with the next steps needed to complete, implement, and sustain the drought risk management action plan presented above. These steps are based on a common[43] model and have been adopted by many African countries with successful outcomes.

Planning, implementation, and monitoring: a ten-step process

The objective of the ten-step process is to derive a plan that is dynamic, reflecting changing government policies, technologies, natural resources management practices, and increasing and shifting populations. It is intended to serve as a checklist to identify the issues that should be addressed in plan development, implementation, and monitoring activities with appropriate modifications.

Step 1 - Appoint a drought task force. The task force, comprised of key ministries under OPM's leadership, would supervise the development of a drought risk management plan. Once the plan is triggered during an emergency, the task force would coordinate actions and implement mitigation actions.

Step 2 - State the purpose and objectives of the drought risk management plan. The task force should clearly define the purpose and role of government in drought mitigation and response efforts; scope of the plan; role of the plan in resolving

[42] NEMA (2007).

[43] Adapted from Wilhite (, 2000). Drought Preparedness and Response in the Context of Sub-Saharan Africa, Drought Preparendess Volume 8, Number 2, June 2000.

Table 38: Proposed DRM actions and indicative costs

Proposed Actions		Indicative Cost		
Time Period	Actions	(US$ mill)	Government Agency	Potential Funding Sources
Short Term (< 1 year)	Strengthen institutional capacity	3	OPM, MWE	Government of Uganda (GOU), World Bank (WB), Development Partners (DP)
	Community-based drought resilience planning	2	OPM, MWE MAAIF, MoLG	GOU, WB, DP, Local Government (LG)
	Develop drought and disaster risk maps	1	OPM, UBOS	GOU, WB, DP
	Strengthen EWS – training/assessment	1	MWE	GOU, WB, DP
	Strengthen income and food safety net (cash transfers, startup family plots)	10	OPM	GOU, WB, DP, WFP
	Best practice (green public works, climate-smart agriculture)	12	OPM, MWE MAAIF	GOU/DP
	Rehabilitate available water points Water availability and quality improvement and surveillance Water demand and supply studies Land use planning and management studies	25	MWE, MAAIF, MOH	GOU, DP
	Coping with malnutrition and disease	1	OPM, MOH	GOU, DP
Medium Term (< 5 years)	Improve drought data	3	MAAIF, MWE, UBOS	GOU, WB, DP
	Strengthen EWS – equipment	10	MWE	GOU, WB, DP
	Water resources development: increase investments in new sources—'water for livestock,' strengthen soil and water conservation Improve watershed-based land use planning, encourage sustainable use of ground water resources	20	MWE, MAAIF	GOU, DP
	Energy: A Lake Victoria Basin knowledge base, monitoring, and decision support system	15	MWE, Energy	GOU, DP
	Environment: Promotion of sustainable land and pasture management practices through district extension services	10	MWE, MAAIF	GOU, DP
	Pastoral Community Development Improving the functioning of the markets Household income diversity Water availability and quality improvement Copying with malnutrition and disease Strengthening the education system	10	OPM, MFPED, MOH, MES, MAAIF	GOU, DP

Table 38: (cont.)

Proposed Actions		Indicative Cost		
Time Period	Actions	(US$ mill)	Government Agency	Potential Funding Sources
Long Term (< 10 years)	Agriculture: Develop and disseminate drought-resistant crop varieties Promote agro-forestry Promote drought-related livelihood opportunities	20	MAAIF	GOU, WB, DP, IITA, WARDA
	Develop infrastructure for water sector and irrigation	30	MWE, MAAIF	GOU, WB, DP
	Promote SLM/SLWM	15	MAAIF	GOU, WB, DP
	Energy: Investments to diversify and sustain power and hydropower generation	50	OPM, MWE,	GOU, WB, DP
	Environment: Afforestation, soil and water conservation, and agro-forestry systems	20	MAAIF, MWE, Wildlife sector	GOU, DP
Total		**258**	**–**	**–**

conflict between water users and other vulnerable population groups during periods of shortage plus resources that the government and others are willing to commit. Clear goals and objectives of the plan should also be developed, along with the criteria for declaring drought and triggering various mitigation and response activities.

Step 3 - Seek stakeholder participation and resolve conflict. Participation of various groups and citizens, especially those who are most vulnerable to drought, are important early on to develop an understanding of one another's various viewpoints and to generate collaborative solutions.

Step 4 - Inventory resources and identify groups at risk. Based on the findings of the drought risk assessment, the spatial areas and communities at risk, potential losses during different scenarios of future drought, and resources available should be identified.

Step 5 - Prepare/write the drought plan. The drought preparedness plan should have three primary components: (i) *capacity building*, including monitoring and early warning, vulnerability and impact assessment, and institutional strengthening; (ii) *community-based drought resilience,* including community-based DRM planning and implementation, and (iii) *mainstreaming in key sectors* to achieve drought mitigation. It is recommended that sub-committees be established with their own specific tasks and goals. A well-established communication and information flow must be kept between the various committees and the Drought Task Force to ensure effective planning.

Step 6 - Identify research needs and fill institutional gaps. Additional research may be needed to develop data on drought or climate change. The institutional gaps assessment and Step 5 may also suggest these needs. The political economy of making decisions, as well as a scientific basis for planning, can provide different views. The task force should develop strong communication and aim to bring together the scientific community with those in charge of political and economic policies to ensure implementation.

Step 7 - Publicize the drought plan, build public awareness, and develop education programs. The plan should be disseminated with an effective communication strategy based on mass media. The public should know who will be responsible for drought response during crisis and what their role should be. A broad-based education and awareness program is needed to raise awareness of water management issues and the drought impacts on agriculture and other sectors of society.

Step 8 - Evaluate and revise the drought plan. Create a detailed set of procedures to ensure adequate plan evaluation. Periodic testing, evaluation, and updating of the drought preparedness plan are essential to keep the plan responsive to local and national needs. To maximize the effectiveness of the system, two modes of evaluation must be in place: ongoing and post-drought evaluation.

Step 9 - Implement the plan activities. Undertake an assessment of which government policies are conducive to drought risk mitigation and which are not. A similar assessment of government programs that are likely to be used for implementing the plan should also be developed. New programs and policies may also be needed to implement the plan. Each committee of different aspects of the drought risk management plan should monitor implementation.

Step 10 - Monitor the outcomes. Clear results indicators and progress benchmarks can be established to evaluate success. The national household survey assessment, national resilience index, and other similar assessments may be helpful in evaluating the outcomes. Step 3 or 8 can be followed at regular intervals to ensure that learning is reflected in plan updates.

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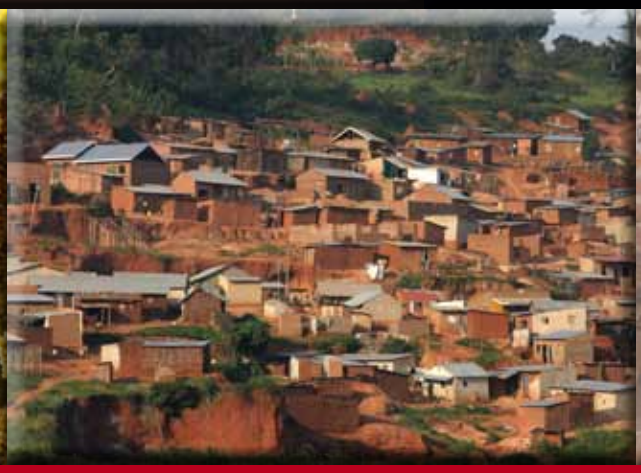


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